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ABSTRACT

Reported are four studies resulting from achievement testing activities from 1971 to 1973 with approximately 17,000 hearing impaired students from under 6 to over 21 years of age. The first study reports the relationships between selected achievement test scores (Paragraph Meaning and Arithmetic Computation subtests) and the following variables: sex, proportion of the school day spent in special educational classes, type of program, age at which formal education was begun, age at onset of the hearing loss, hearing status of parents, degree of hearing loss, nonverbal IQ test score, and presence or absence of additional handicapping conditions. The second study reports on the extent of guessing or "chance" level scores in the achievement tests of hearing impaired students and reviews the literature related to the question of guessing and correction for guessing in objective psychometric tests. The third study reports the intercorrelations among the various subtests within each of the five batteries of the Stanford Achievement Test. The intercorrelations for hearing impaired students are compared to the data for hearing students and are examined according to the age of the hearing impaired students. The fourth study reports the results of a mail survey of special educational programs for hearing impaired students regarding the extent of usage of various achievement tests. The implications of these results for future testing activities are considered. Also included are descriptions of the data collection methods, the qualifications and limitations of the data, and the demographic characteristics of the students in the 1971 testing program. (Author/DB)

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NUMBER 13

FURTHER STUDIES IN ACHIEVEMENT TESTING, HEARING IMPAIRED STUDENTS

UNITED STATES: SPRING 1971

DATA FROM THE ANNUAL SURVEY OF HEARING IMPAIRED CHILDREN AND YOUTH

OFFICE OF DEMOGRAPHIC STUDIES
GALLAUDET COLLEGE

Washington, D.C.

September 1973

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September, 1973

ABSTRACT

This publication includes four studies resulting from the achievement testing activities of the Annual Survey of Hearing Impaired Children and Youth. The first three studies are based on data obtained in the 1971 National Achievement Testing Program; the fourth is a report of a survey conducted during the 1972-73 school year.

The first study reports the relationships between selected achievement test scores (Paragraph Meaning and Arithmetic Computation Sub-tests) of 8, 11, 14, and 17 year old hearing impaired students and the following variables: sex, proportion of the school day spent in special educational classes, type of program, age at which formal education was begun, age at onset of the hearing loss, hearing status of parents, degree of hearing loss, non-verbal I.Q. test score, and presence/absence of additional handicapping conditions. These relationships are considered only as functional associations, without causal implications.

The second study reports on the extent of guessing or "chance" level scores in the achievement tests of hearing impaired students and reviews the literature related to the question of guessing and correction for guessing in objective psychometric tests.

The third study reports the intercorrelations among the various sub-tests within each of the five batteries of the Stanford Achievement Test. The intercorrelations for hearing impaired students are compared to the data for hearing students and are examined according to the age of the hearing impaired students.

The fourth study reports the results of a mail survey of special educational programs for hearing impaired students regarding the extent of usage of various achievement tests. The implications of these results for future testing activities of the Annual Survey are considered.

Descriptions of the data collection methods, of the qualifications and limitations of the data, and of the demographic characteristics of the students in the 1971 testing program are included in the report.

The Annual Survey of Hearing Impaired Children and Youth is conducted by the Office of Demographic Studies at Gallaudet College. The major source of support is grant funds from the National Institute of Education, Department of Health, Education and Welfare. The additional funding is provided by Gallaudet College.

FURTHER STUDIES IN ACHIEVEMENT TESTING, HEARING IMPAIRED STUDENTS UNITED STATES: SPRING 1971

INTRODUCTION

This publication is the fourth to appear with analyses of data resulting from the 1971 National Achievement Testing Program conducted by the Annual Survey of Hearing Impaired Children and Youth. It represents part of the continuing effort of the Annual Survey to provide national data on the academic achievement of hearing impaired students and to determine the appropriateness and suitability of standard achievement tests for this student population.

Since its inception, the Annual Survey has devoted part of its resources to collecting and analyzing achievement test information on students attending special educational programs for the hearing impaired; this Survey effort was in response to the widely expressed need for information of this nature. The longer range purposes of this activity are to determine the suitability of existing achievement tests for these students and to develop procedures and materials designed to enhance the usefulness and accuracy of achievement testing results.

This publication presents the results of four studies. Three of these studies were undertaken with data collected on a national group of hearing impaired students who were administered the Stanford Achievement Test in the spring of 1971. The fourth is the report of a survey taken during the 1972-73 school year of the usage of standardized achievement tests in educational programs for hearing impaired students. An examination of the characteristics of nearly 17,000 of the hearing impaired students who participated in the testing program is presented in Appendix I. These characteristics are compared with those of the 41,109 hearing impaired students for whom data were reported to the Annual Survey during the 1970-71 school year.

The first study is concerned with the relationship between achievement test scores and a series of variables other than those for which data have been presented in previous publications from the Annual Survey. The following variables are examined: sex, proportion of the school day spent in special educational classes, type of special educational program, age at which formal education was begun, age at onset of the hearing loss, hearing status of parents, degree of hearing loss, non-verbal I.Q. scores, and presence or absence of additional handicapping conditions. The relationships are displayed as a simple function of dichotomizing each of the variables and calculating a mean and standard deviation for each resulting group of students in the 8, 11, 14, and 17 year old age categories. The relationships are described purely as functional associations, without any implications of causality, for the purpose of suggesting potentially fruitful areas for future research consideration. The demographic variables are considered in relation to scores on Paragraph Meaning and Arithmetic Computation, two sub-tests which are, respectively, among

the lowest and the highest scores obtained by hearing impaired students. The differential degrees of relatedness of the nine variables to these two sub-test scores are also examined.

The second study relates to the often raised question of the influence and extent of guessing on achievement (and other) tests written in multiple-choice format. The literature in this regard is reviewed briefly, and data obtained from samples of students tested in the 1971 testing program are presented. The results indicate that guessing was a relatively minor problem on the majority of sub-tests studied in terms of the extent of its occurrence. The results also suggest that in the great majority of cases, scores which do occur at or below the "chance" level are due to guessing rather than to lack of time to complete the test or to other factors.

The third study examines the intercorrelations among the sub-tests of the five batteries of the Stanford tests for hearing impaired students. These intercorrelations are compared, first, to similar figures for the hearing standardization sample upon which the norms of the Stanford are based. Next, the intercorrelations are examined with reference to the age of the examinees. The first comparison indicates generally lower intercorrelations for the hearing impaired group than for the standardization sample. The second comparison, by age, generally shows decreasing correlations as age increases for hearing impaired students, a situation which is the reverse of the general trend among students in the standardization sample. In all cases, however, the differences are not great, and the Stanford tests are seen to exhibit psychometric properties when used with hearing impaired students which are very similar to those exhibited with the national sample of hearing students.

The final study, the only one in this publication not based on data from the 1971 testing program, reports the results of a mail survey conducted during the 1972-73 school year regarding the usage of achievement tests in educational programs for hearing impaired students. A total of over 850 programs were asked whether they plan to use a standardized achievement test during the 1972-73 and 1973-74 school years, which test(s) they plan to use if any, and the number of students to be tested. A large majority of the responding programs who plan to use some achievement test(s) reported that they plan to use the Stanford Achievement Test, either alone or in combination with some other test(s). Among programs planning to use only a single test, the Stanford will reportedly be used with more than 15 times as many students as the next most frequently used test. The implications of these findings for the future achievement testing activities of the Annual Survey are discussed.

Three publications on the results of the 1971 National Achievement Testing Program conducted by the Annual Survey of Hearing Impaired Children and Youth have already appeared. In the first two of these,[1] the background of this testing program and the many qualifications relating to use of its results appeared at the beginning of the publication. On the assumption that those interested in the results of this testing program had already twice read this material, it was printed as an appendix to the third such publication.[2] This material appears again as Appendix II to this publication. Anyone not familiar with this material, especially the qualifications of the data upon which these studies are based, should read this appendix. Appendix III will provide background information on the standardized testing procedures developed for the 1971 Achievement Testing Program.

---

[1] *Item Analysis of an Achievement Testing Program for Hearing Impaired Students, United States: Spring 1971.* Gallaudet College, Office of Demographic Studies, Series D, Number 8.

Academic Achievement Test Results of a National Testing Program for Hearing Impaired Students, United States: Spring 1971. Gallaudet College, Office of Demographic Studies, Series D, Number 9.

[2] *Studies in Achievement Testing, Hearing Impaired Students, United States: Spring 1971.* Gallaudet College, Office of Demographic Studies, Series D, Number 11.

Associations Between Achievement Test Performance and Selected Characteristics of Hearing Impaired Students in Special Educational Programs: United States, Spring 1971

Peter Ries

INTRODUCTION

Three previous publications have reported results of the Achievement Testing Program conducted by the Annual Survey of Hearing Impaired Children and Youth in the spring of 1971.[1] Apart from age and degree of hearing loss,[2] the test results have not yet been presented in terms of their relationship with other basic variables upon which a data file is maintained for all students participating in the Annual Survey.

The purpose of this report is limited to displaying the association between the test scores for four selected ages on the Paragraph Meaning and Arithmetic Computation Sub-tests of the Stanford Achievement Test and the following variables: sex, proportion of the school day spent in special educational classes, type of special educational program, age beginning formal education, age at onset of hearing loss, hearing status of parents, degree of hearing loss, non-verbal I.Q., and additional handicapping conditions. The relationships are presented as a simple function of dichotomizing as nearly as possible each of the variables and calculating a mean and a standard deviation for each resulting group of 8, 11, 14, and 17 year old hearing impaired students in special educational programs for whom the data were reported on a given variable during the 1970-71 school year.

In some cases, such as sex, the criterion for dividing the scores into two contrasting groups is clear-cut. In other cases, there is a necessary arbitrary element in the choice of a criterion. Thus, for instance, "before six years old" and "six years and after" are the reasonable but not necessary categories associated with the variable, "age beginning formal education." The criteria used to dichotomize each of the variables will be specified in the presentation of the results; and, where necessary, the rationale for the choice will be indicated.

The results are presented for the Paragraph Meaning and Arithmetic Computation Sub-tests because these two sub-tests ordinarily provide the lowest and highest scores for hearing impaired students and because they are sub-tests common to all five levels of the 1964 edition of the Stanford Achievement Test.[3] Also, it should be noted that the means referred to are grade equivalents and represent the weighted results for all of the batteries taken by each of the ages for which scores are reported. Thus, for instance, the means for 17 year old students result from weighting the means in terms of the number of

[1] See Footnotes 1 and 2 on page 2.

[2] See Annual Survey publication Series D, Number 9.

[3] In the Primary 1 Battery Arithmetic Computation appears as one of the four sections of the Arithmetic Subtest.

17 year old students who took each of the five batteries of the Stanford series.

Background information on the achievement testing program from which these results are drawn and a statement of the limitations associated with the use of these data appear as Appendix II of this publication. Limitations associated with the validity and reliability of the data on the variables used in this report may be found in the Annual Survey's D-10 publication.[4]

In concluding this introduction, the very limited purpose of this report should be emphasized. Mere associations between test results and dichotomized variables for selected ages are discussed; there is no suggestion that such associations represent the basis for causal statements. Thus, for instance, the fact that the scores for students who are reported to have attended preschool programs are higher than those for students who did not attend such programs is *not* in itself an adequate basis to conclude that attendance in preschool programs causes increased academic achievement for hearing impaired youngsters. Students who did and those who did not attend preschool programs differ in other regards, and these differences undoubtedly play some part in determining the divergences in the scores of these two groups.

Plans are underway to submit the data which serve as the basis of this report to more sophisticated and meaningful statistical analysis. The limited results to be found here are being published because it will be some time before the planned analysis can be completed; and in the meantime, these results may serve as a basis for suggesting types of specialized analyses that researchers in the field of educating hearing impaired youth may wish to request of the Annual Survey.

HIGHLIGHTS OF THE RELATIONSHIPS

In this section graphs will be used to highlight the relationships between nine selected variables and the achievement test scores of 8, 11, 14, and 17 year old hearing impaired students on the Paragraph Meaning and Arithmetic Computation Sub-tests. The results for each of the sub-tests will be presented in parallel graphs; in this way the results for each of the groups which emerge from dichotomizing a variable can be compared on the two sub-tests simultaneously.

All of the results discussed in this section and the next derive from Detailed Tables A and B which appear at the end of this report. In both of these sections the scores for the groups for whom information was not available on a given variable are omitted. The scores and the standard deviations for these "unknown" groups do appear in the tables at the end of the report. Since the means for the "unknown" group do not always fall between the means for the groups dichotomized for a given variable, it cannot be assumed that the "unknowns" are distributed like the "knowns" for all variables. This fact should be taken into account in any attempt to interpret the results for any given variable. As may be noted in the Detailed Tables, age beginning formal education, hearing status of parents, degree of hearing loss, and non-verbal I.Q., all have high percentages of students for whom data were not reported. In addition, the total number of students included in each of the groups we will be considering may be found in these tables.

SEX

In the hearing population females ordinarily outperform males in the Paragraph Meaning Sub-test of the Stanford Achievement Test.[5] As may be seen in Figure 1, this relationship is reflected in the scores of the hearing impaired students included in this study. On the other hand, males in the hearing population tend to outperform females on the Arithmetic Computation Sub-test. As the graph indicates, this relationship does not hold true for the hearing impaired group, except for the 17 year old students. In any case, the differences between the performance of males and females are extremely small, never exceeding more than two-tenths of a grade.

PROPORTION OF THE SCHOOL DAY SPENT IN SPECIAL EDUCATIONAL CLASSES

Figure 2 shows the relationships between the test scores and proportion of the school day spent in special classes. For this variable, "full-time" refers to students in residential and day schools and in full-time classes for the hearing impaired. "Part-time" refers to students who are in part-time classes, who are in itinerant programs, or who have access to a resource room.

This variable is among those showing the larger differences in the mean scores between the two groups. The difference is least for 8 year old students and is especially pronounced for the Paragraph Meaning Sub-test.

Consideration of this variable may serve as a reminder of the earlier statement that claims regarding relationships based on the data in this report should not be interpreted as causal statements. Students in part-time special educational programs are known to have less of a hearing loss on the average

[4] *Characteristics of Hearing Impaired Students by Hearing Status, United States: 1970-71.* Gallaudet College, Office of Demographic Studies, Series D, Number 10, pp. 2-3.

[5] Kelley, T. L., Madden, R., Gardner, E. F., Rudman, H. C. *Stanford Achievement Test Technical Supplement.* New York: Harcourt, Brace & World, Inc., 1966, p. 29.

FIGURE 1: MEAN GRADE EQUIVALENT SCORES FOR ALL BATTERIES AND SELECTED AGES BY SEX FROM THE ANNUAL SURVEY'S 1971 ACHIEVEMENT TESTING PROGRAM.

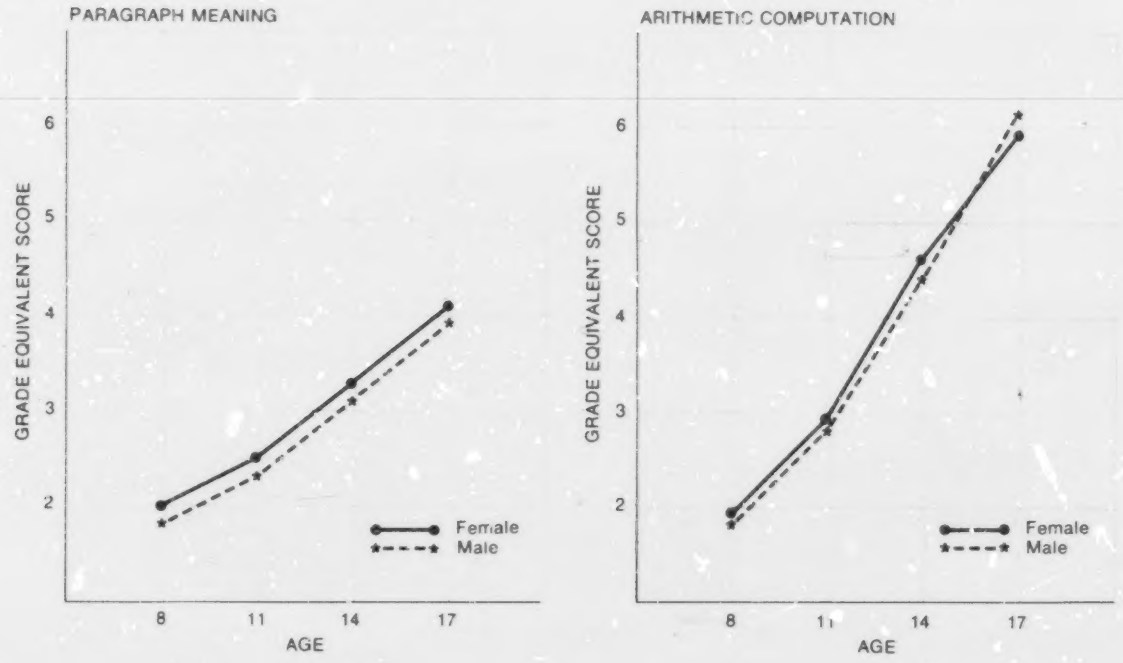


FIGURE 2: MEAN GRADE EQUIVALENT SCORES FOR ALL BATTERIES AND SELECTED AGES BY PROPORTION OF THE SCHOOL DAY SPENT IN SPECIAL EDUCATIONAL CLASSES FROM THE ANNUAL SURVEY'S 1971 ACHIEVEMENT TESTING PROGRAM.

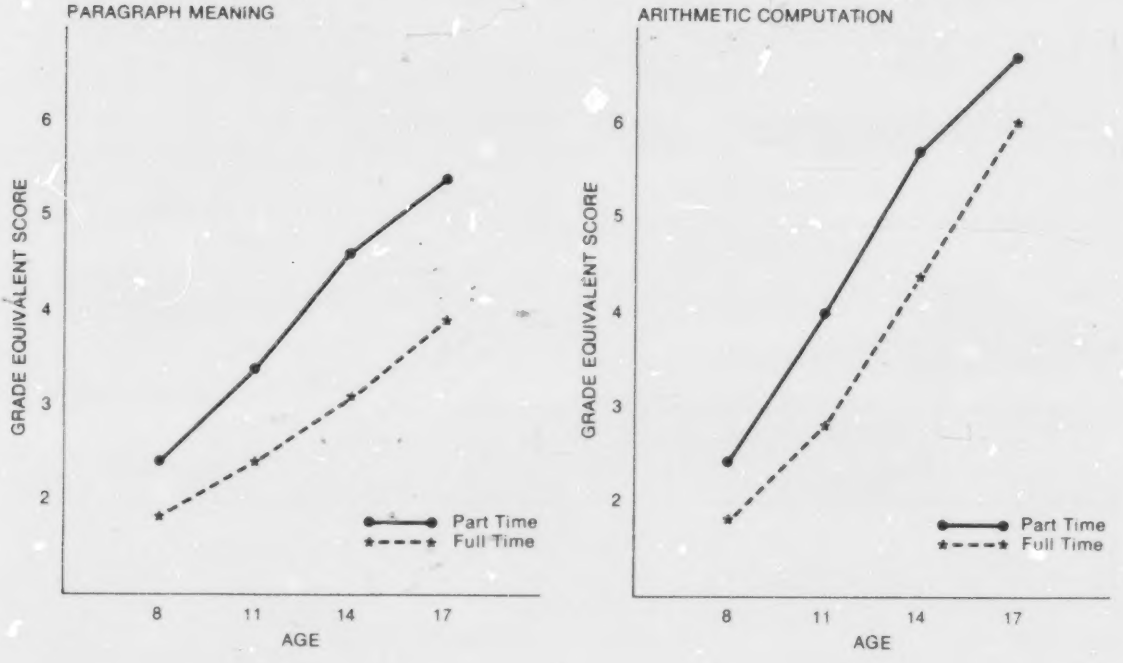
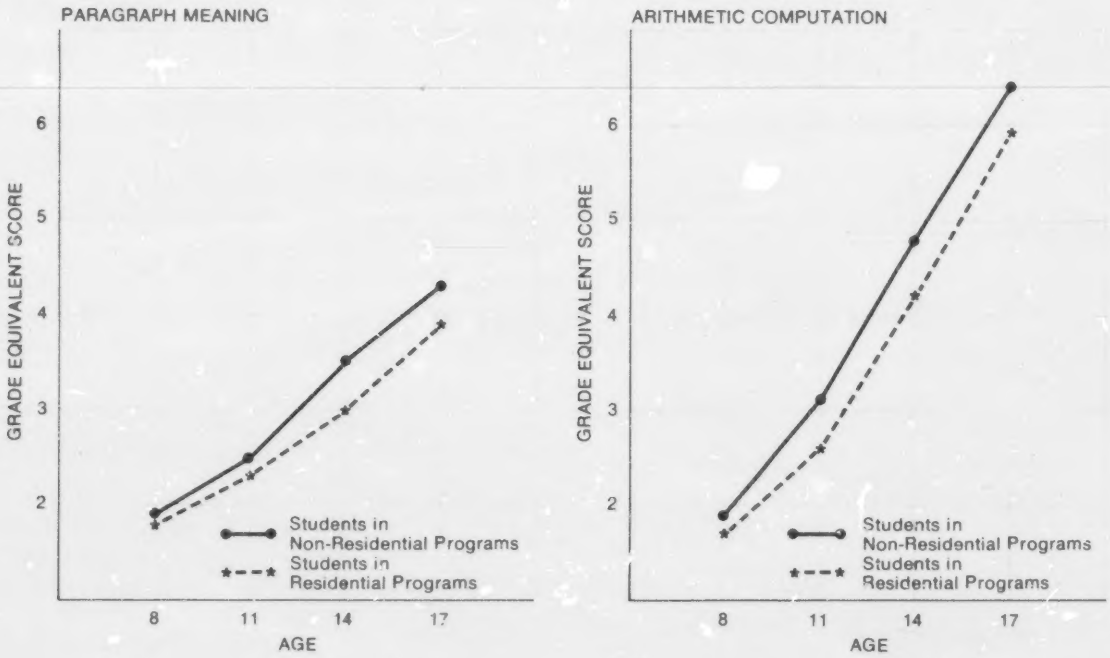


FIGURE 3: MEAN GRADE EQUIVALENT SCORES FOR ALL BATTERIES AND SELECTED AGES BY TYPE OF SPECIAL EDUCATIONAL PROGRAM FROM THE ANNUAL SURVEY'S 1971 ACHIEVEMENT TESTING PROGRAM.



than students in full-time programs,[6] and part of the difference between the scores for these two groups undoubtedly derives from this fact. Other differences which affect educational outcome exist between students in these two types of programs, and it is therefore not legitimate on the basis of these data alone to conclude that participation in regular classes enhances the academic achievement of hearing impaired students.

TYPE OF PROGRAM

A comparison of scores for students in "residential" and "non-residential" programs appears in Figure 3. It should be emphasized that the comparison here is based on the type of program and *not* on the type of student. Thus, day students in residential programs are included under the category "residential program." Further, it should be noted that a proportion of the students in the "non-residential" program category are receiving only part-time special educational services. Since these part-time students ordinarily receive higher achievement test scores, part of the difference between the mean grade equivalent scores of students in residential programs and students in day programs is due to their inclusion in the latter group.

[6]See Annual Survey publication D-10, p. 12.

AGE BEGINNING FORMAL EDUCATION

For 11, 14, and 17 year old students, the scores of those who attended preschool programs are between two-tenths and five-tenths of a grade higher on the Paragraph Meaning Sub-test and between five-tenths and one and two-tenths of a year higher on the Arithmetic Computation Sub-test. However, as may be noted in Figure 4, the scores for 8 year old students are approximately equal. In fact, the 8 year old students who are reported not to have attended a formal educational program prior to their sixth year score about one-tenth of a grade higher on the Paragraph Meaning Sub-test than do the students who are reported to have attended a preschool program.

AGE AT ONSET OF HEARING LOSS

Figure 5 reveals almost no differences in achievement test scores between those students whose age at onset of hearing loss was reported as "at birth" and those with onset reported as "after birth." The largest difference is only four-tenths of a grade for 17 year old students on the Paragraph Meaning Sub-test. It is possible that differences might have appeared had the distinction "pre-lingual" and "post-lingual" (under three years of age

FIGURE 4: MEAN GRADE EQUIVALENT SCORES FOR ALL BATTERIES AND SELECTED AGES BY AGE BEGINNING FORMAL EDUCATION FROM THE ANNUAL SURVEY'S 1971 ACHIEVEMENT TESTING PROGRAM.

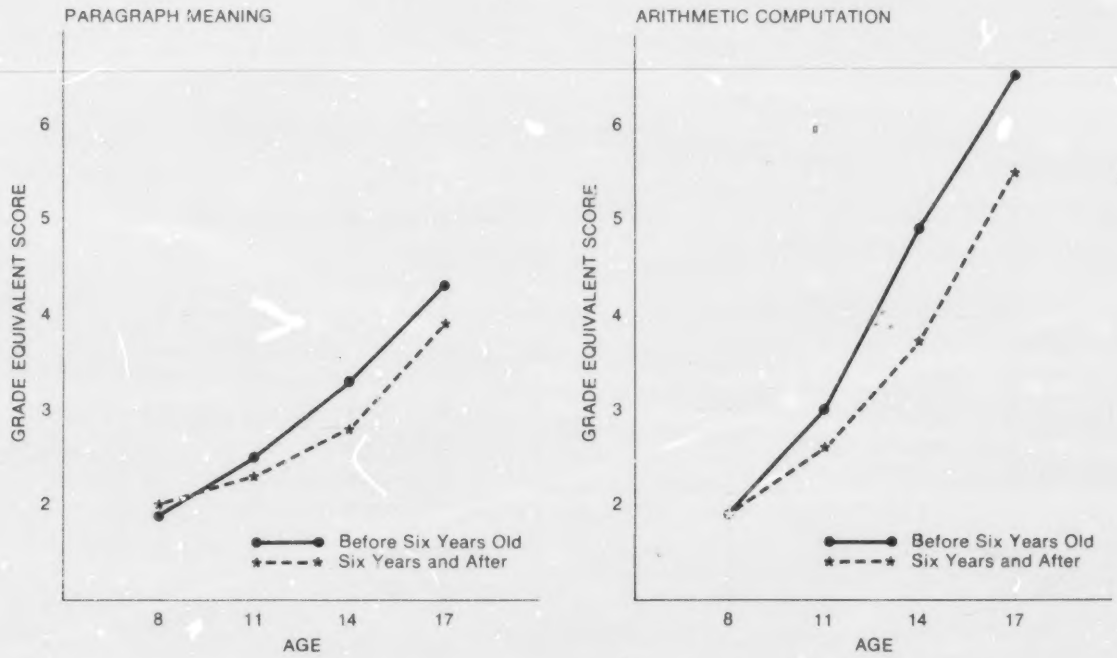
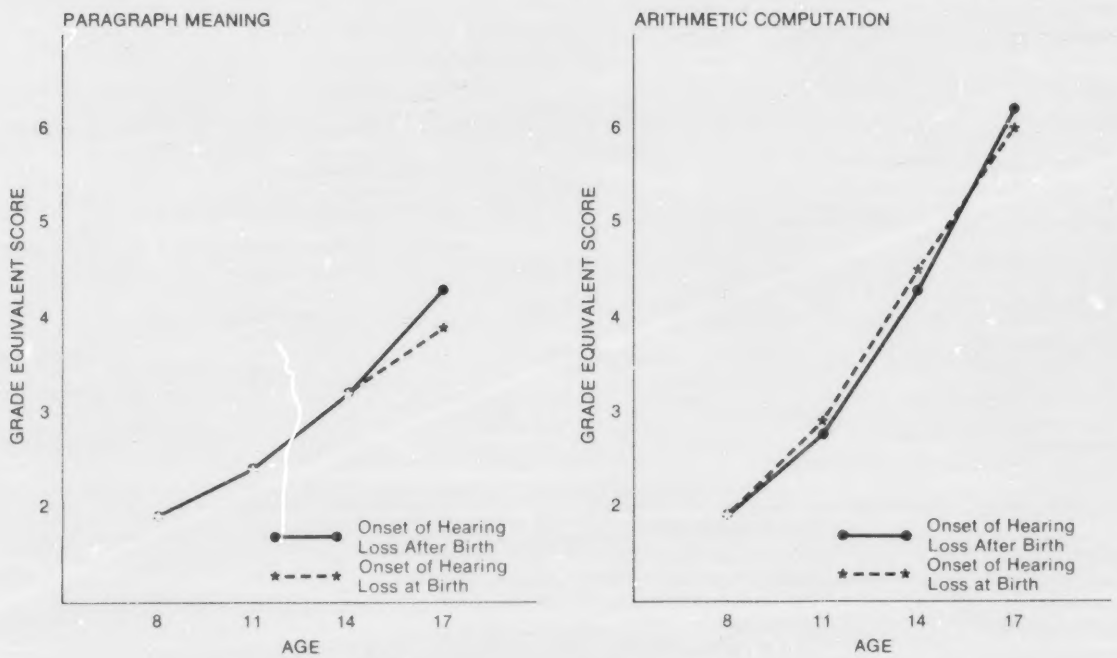


FIGURE 5: MEAN GRADE EQUIVALENT SCORES FOR ALL BATTERIES AND SELECTED AGES BY AGE AT ONSET OF HEARING LOSS FROM THE ANNUAL SURVEY'S 1971 ACHIEVEMENT TESTING PROGRAM.



and three years of age or older, for instance) been used to distinguish the two groups.

Table 1 indicates the distribution by age at onset of those students in the Achievement Testing Program on whom data were reported for this variable. As may be noted, only a very small proportion of these students has a post-lingual age at onset of hearing loss. Because the pre-lingual/post-lingual dichotomy would have produced so few scores for the post-lingual group, the distinction between "onset of hearing loss at birth" and all other onsets ("onset of hearing loss after birth") was used to distinguish the groups.

TABLE 1: DISTRIBUTION BY AGE AT ONSET OF HEARING LOSS OF STUDENTS IN THE ANNUAL SURVEY'S 1971 ACHIEVEMENT TESTING PROGRAM.

Age at Onset	Students in the Achievement Testing Program	
	Number	Percent
Total Students	16,908	100.0
Information Not Reported	2,319	13.7
Total Reported	14,589	100.0
Birth	11,269	77.2
After Birth but Under 3 years	2,541	17.4
3 Years and Over	779	5.3

HEARING STATUS OF PARENTS

This variable, as can be seen in Figure 6, was broken down into "at least one deaf parent" and "no deaf parent(s)" and was based on whether the student's mother or father had normal hearing or a hearing impairment prior to age six. If on the survey questionnaire one parent was marked as "deaf" and the other was "unknown," then the student was classified as having "at least one deaf parent"; if, on the other hand, one parent was marked as "hearing" and the other as "unknown," then the student was placed in the "unknown" category. Only if both parents were marked as "hearing" was the student placed in the "no deaf parents" category.

The results for this variable are in line with the finding of other research showing the relationship between the performance of hearing impaired students of deaf parents and those of hearing parents. Again, it should be emphasized that the data support this finding only in the context of students attending special educational programs. To the degree that

FIGURE 6: MEAN GRADE EQUIVALENT SCORES FOR ALL BATTERIES AND SELECTED AGES BY HEARING STATUS OF PARENTS FROM THE ANNUAL SURVEY'S 1971 ACHIEVEMENT TESTING PROGRAM.

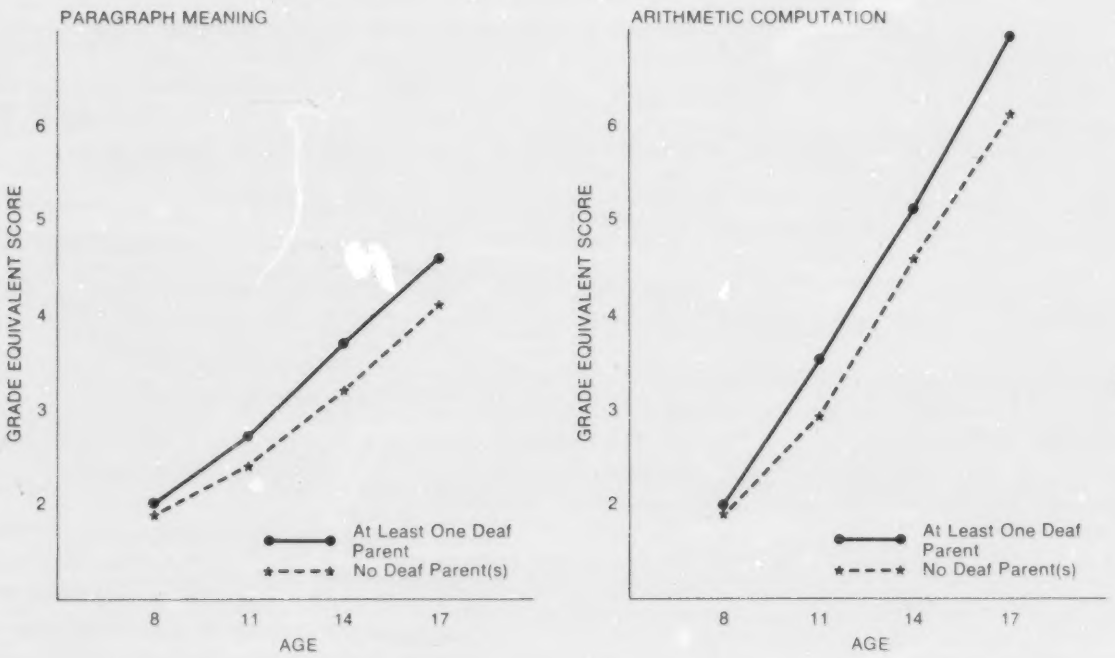
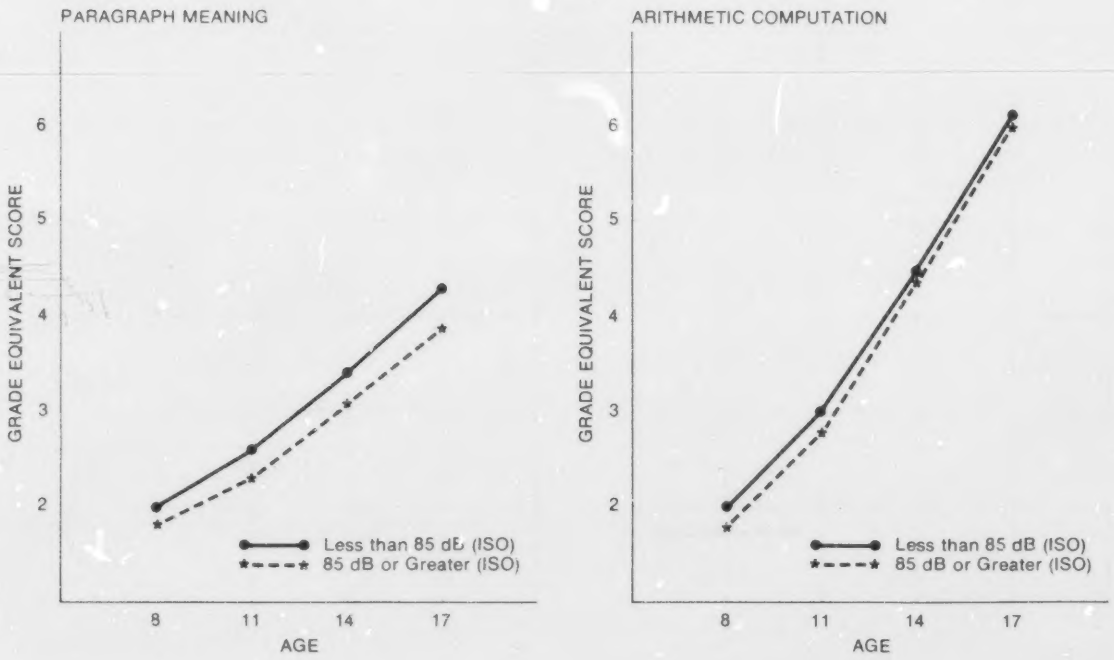


FIGURE 7: MEAN GRADE EQUIVALENT SCORES FOR ALL BATTERIES AND SELECTED AGES BY DEGREE OF HEARING LOSS FROM THE ANNUAL SURVEY'S 1971 ACHIEVEMENT TESTING PROGRAM.



hearing parents are more likely to send their hearing impaired children — especially if he or she is bright — to a regular school program than would the deaf parents of a hearing impaired child, the students reported on in this article cannot be said to reflect a representative group of hearing impaired students.

In interpreting the results for this variable special caution should be exercised for another reason. As may be seen in Detailed Tables A and B, for some as yet unexplained reason and contrary to usual expectations, the means for the "unknown" group consistently fall below the means for the students with at least one deaf parent and for the students with hearing parents. This occurs on both the Paragraph Meaning and the Arithmetic Computation Sub-tests. This strongly suggests that the characteristics of the students for whom information was not reported on this variable are not the same as for the students on whom the data were reported.

DEGREE OF HEARING LOSS

The results for this variable are shown in Figure 7. They are presented here so that the reader may examine the relationships regarding this variable in a format similar to that used for the other variables. However, more detailed results regarding the relationship between degree of hearing loss, age, and achievement test scores may be found in a previous publication of the Annual Survey, *Academic Achievement Test Results of a National Testing Program for Hearing Impaired Students, United States: Spring 1971 (D-9)*.

The results in that publication are presented in terms of three categories of hearing loss: 59dB and below,[7] 60-98dB, and 99dB and above; in general, these results suggest that the differences in scores based on hearing threshold levels derive mostly from the "59dB and below" category, which contains a proportionally small number of students. Thus, much of the association between the degree of hearing loss and achievement test scores is masked in Figure 7 by the fact that the major proportion of the students in the "less than 85dB" category have hearing losses between 60 and 84dB.

In general, then, the relationships depicted in Figure 7 tend to underestimate the influence of the lower levels of hearing loss on the test scores.

[7] All decibel levels are given for the ISO standard.

NON-VERBAL I.Q. SCORES[a]

Not unexpectedly, as can be seen in Figure 8, this is the variable showing the largest difference between the two contrasted groups. The association between I.Q. scores and achievement test scores is well known. What is somewhat surprising is that the pattern of the results between the two sub-tests for this variable does not differ significantly from the other variables we have considered.

One might expect that since the intelligence of the students is being measured by a relatively non-verbal procedure and the Arithmetic Computation Sub-test has a far lighter language load than does the Paragraph Meaning Sub-test, the differences between the two groups of students would be extremely large for the Arithmetic Computation Sub-test and relatively small in the Paragraph Meaning Sub-test where the language load is obviously heavy.

It should be emphasized that the difference in achievement test scores between the high and low I.Q. groups is greater on the Arithmetic Computation Sub-test than on the Paragraph Meaning Sub-test, and it is only the fact that it is not far greater that is being noted.

[a]The I.Q. scores discussed here are those that were reported to the Annual Survey from the individual schools and programs in the Survey; moreover, since these I.Q. scores were derived from different tests, which consequently have different norms, care should be exercised in the interpretation of the data in this section.

ADDITIONAL HANDICAPPING CONDITIONS

In Figure 9 the results regarding this variable indicate a relatively large difference between the scores for the hearing impaired student with no additional handicapping condition and those for the multiply handicapped hearing impaired student.

These results offer support for the contention that studies relating to hearing impaired students should, whenever possible, distinguish between the multiply handicapped hearing impaired youngster and the hearing impaired youngster with no additional handicaps. Such a consideration takes on added significance when it is recognized that more than one-quarter of the students on whom the Annual Survey receives data for additional handicaps are reported as having one or more handicaps in addition to their hearing impairment.

On the other hand, aside from the magnitude of the difference, the pattern of the results for this variable resembles that of most of the other variables we have already considered in that (1) the scores for both groups on both sub-tests are similar for the 8 year olds, and (2) the improvement in scores at the higher ages is much more marked on the Arithmetic Computation Sub-test than on the Paragraph Meaning Sub-test.

FIGURE 8: MEAN GRADE EQUIVALENT SCORES FOR ALL BATTERIES AND SELECTED AGES BY NON-VERBAL I.Q. FROM THE ANNUAL SURVEY'S 1971 ACHIEVEMENT TESTING PROGRAM.

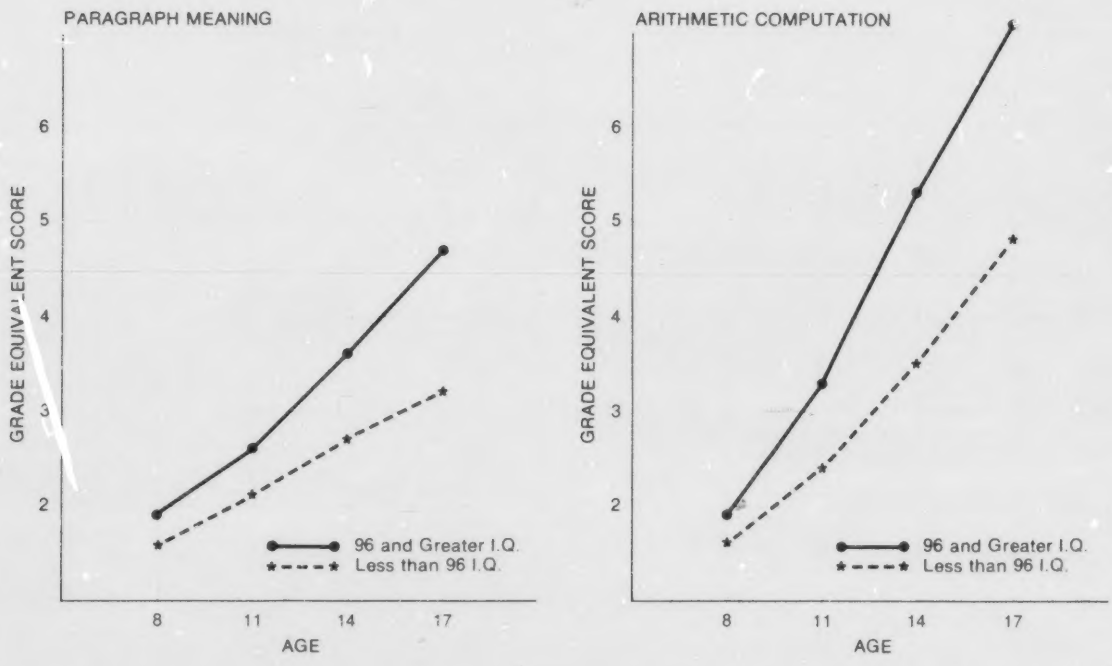
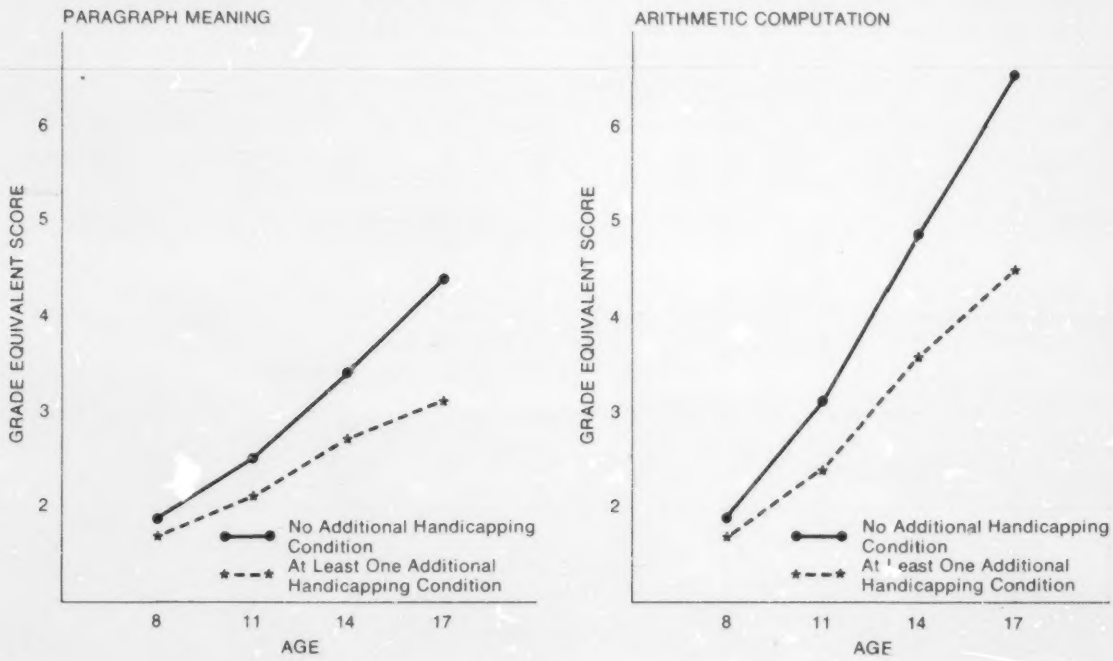


FIGURE 9: MEAN GRADE EQUIVALENT SCORES FOR ALL BATTERIES AND SELECTED AGES BY ADDITIONAL HANDICAPPING CONDITIONS FROM THE ANNUAL SURVEY'S 1971 ACHIEVEMENT TESTING PROGRAM.



SUMMARY: OVERALL DIFFERENCES

In the previous sections we have viewed two types of differences for contrasting groups of students in the Annual Survey's 1971 Achievement Testing Program in relation to selected ages. The first type of difference related to how the mean grade equivalent scores for the two groups of students differed on each of two sub-tests of the Stanford Achievement Test. The second related to a comparison of these differences between the Paragraph Meaning and Arithmetic Computation Sub-tests.

If we disregard age and average the differences for the four ages for each variable and each sub-test, we obtain the results shown in Chart 1. These results merely summarize the data discussed in the previous section. They may be viewed either in terms of the average difference between the scores for each sub-test or in relation to whether the differences are greater or less for the Paragraph Meaning or Arithmetic Computation Sub-tests.

Averaging the results of the two sub-tests for each variable, we may rank the first type of differences from those variables where the two groups score approximately equally to those in which there is a great difference between the scores for each group.

Chart 1 indicates the ranking of the difference between the differences of the two groups for each variable when grade equivalents are calculated by dichotomizing the students' scores, subtracting the lower score from the higher, and averaging the differences for the four ages. As may be noted, the larger differences appear for non-verbal I.Q., proportion of the school day spent in special educational classes, and additional handicapping conditions. The smallest difference appears for age at onset of hearing loss.

The ranking of these differences is based on averaging the differences for the Paragraph Meaning and Arithmetic Computation Sub-tests. When the relative size of these differences for each of the variables for each sub-test is considered, the results shown in Table 2 are obtained. Age at onset cannot be classified because it is not consistent in terms of the dichotomization, with the "after birth" group scoring higher than the "at birth" group on the Paragraph Meaning Sub-test and the "at birth" group scoring higher on the Arithmetic Computation Sub-test.

Speculative reasons could be offered as to why the differences between the differences are greater for the Paragraph Meaning Sub-test on some variables and greater for the Arithmetic Computation Sub-test on other variables. However, for the limited purposes of this report it is judged sufficient merely to have highlighted this aspect of the results.

CHART 1: RANKING OF THE DIFFERENCE BETWEEN THE MEAN DIFFERENCES OF PARAGRAPH MEANING AND ARITHMETIC COMPUTATION SUB-TESTS OF THE STANFORD ACHIEVEMENT TEST FOR THE 8, 11, 14, AND 17 YEAR OLD AGE GROUPS.

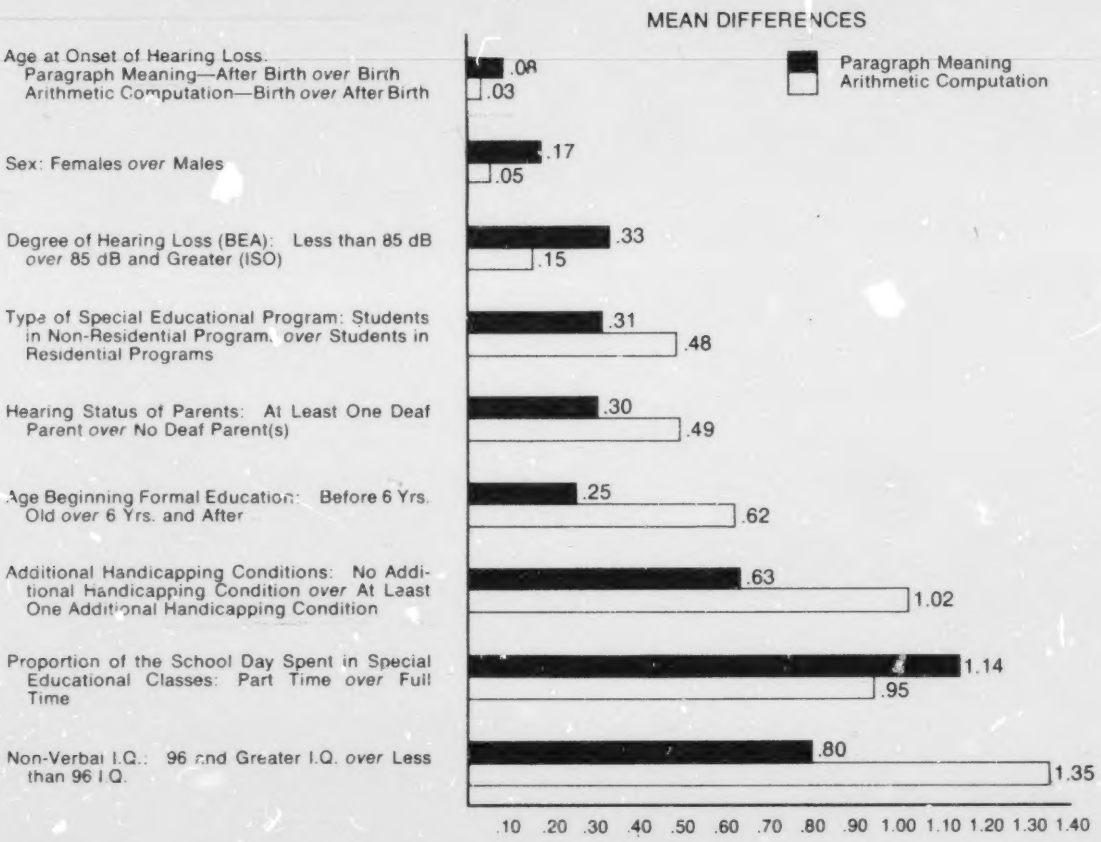

MEAN DIFFERENCES
Paragraph Meaning
Arithmetic Computation
Age at Onset of Hearing Loss. Paragraph Meaning—After Birth over Birth Arithmetic Computation—Birth over After Birth
.08
.03
Sex: Females over Males
.17
.05
Degree of Hearing Loss (BEA): Less than 85 dB over 85 dB and Greater (ISO)
.33
.15
Type of Special Educational Program: Students in Non-Residential Program. over Students in Residential Programs
.31
.48
Hearing Status of Parents: At Least One Deaf Parent over No Deaf Parent(s)
.30
.49
Age Beginning Formal Education: Before 6 Yrs. Old over 6 Yrs. and After
.25
.62
Additional Handicapping Conditions: No Additional Handicapping Condition over At Least One Additional Handicapping Condition
.63
1.02
Proportion of the School Day Spent in Special Educational Classes: Part Time over Full Time
1.14
.95
Non-Verbal I.Q.: 96 and Greater I.Q. over Less than 96 I.Q.
.80
1.35
.10 .20 .30 .40 .50 .60 .70 .80 .90 1.00 1.10 1.20 1.30 1.40

TABLE 2: RANKING OF VARIABLES RELATIVE TO THE TYPE AND SIZE OF THE DIFFERENCES BETWEEN THE SCORES FOR THE PARAGRAPH MEANING AND ARITHMETIC COMPUTATION SUB-TESTS OF THE STANFORD ACHIEVEMENT TEST: SPRING 1971.

Differences In Paragraph Meaning Greater	Amount of Difference in Grade Equivalents	Differences In Arithmetic Computation Greater	Amount of Difference in Grade Equivalents
1. Proportion of School Day Spent in Special Educational Classes	0.19	1. Non-Verbal I.Q.	0.55
2. Degree of Hearing Loss	0.18	2. Additional Handicapping Conditions	0.39
3. Sex	0.12	3. Age Beginning Formal Education	0.37
		4. Hearing Status of Parents	0.19
		5. Type of Special Educational Program	0.17

TABLE A: NUMBER, MEANS, AND STANDARD DEVIATION OF THE PARAGRAPH MEANING SUB-TEST OF THE STANFORD ACHIEVEMENT TEST AS ADMINISTERED TO 8, 11, 14, AND 17 YEAR OLD HEARING IMPAIRED STUDENTS IN PARTICIPATING SPECIAL EDUCATIONAL PROGRAMS FOR THE HEARING IMPAIRED: UNITED STATES, 1970-71 SCHOOL YEAR.

	8 Year Old Students			11 Year Old Students			14 Year Old Students			17 Year Old Students		
	N	Mean	Stan Dev.	N	Mean	Stan Dev.	N	Mean	Stan Dev.	N	Mean	Stan Dev.
Sex												
Male	349	1.84	0.55	848	2.34	0.86	834	3.06	1.44	676	3.93	1.88
Female	341	1.96	0.58	746	2.47	0.87	732	3.32	1.39	563	4.12	1.82
Unknown	0	–	–	0	–	–	0	–	–	0	–	–
Total	690	1.90	0.56	1594	2.40	0.87	1566	3.18	1.42	1239	4.02	1.86
Proportion of the School Day Spent in Special Educational Classes												
Full Time	616	1.84	0.43	1512	2.35	0.80	1476	3.09	1.34	1162	3.93	1.81
Part Time	74	2.42	1.05	82	3.37	1.41	90	4.59	1.91	77	5.36	2.06
Unknown	0	–	–	0	–	–	0	–	–	0	–	–
Total	690	1.90	0.56	1594	2.40	0.87	1566	3.18	1.42	1239	4.02	1.86
Type of Special Educational Program												
Students in Residential Programs	196	1.82	0.40	739	2.27	0.68	946	2.99	1.21	866	3.90	1.79
Students in Non-Residential Programs	494	1.93	0.62	855	2.51	0.99	620	3.47	1.65	373	4.30	1.97
Unknown	0	–	–	0	–	–	0	–	–	0	–	–
Total	690	1.90	0.56	1594	2.40	0.87	1566	3.18	1.42	1239	4.02	1.86
Age Beginning Formal Education												
Before 6 Yrs. Old	504	1.90	0.51	872	2.48	0.91	689	3.30	1.32	504	4.26	1.83
6 Yrs. and After	70	1.96	0.93	358	2.28	0.83	432	2.83	1.21	339	3.87	2.01
Unknown	116	1.88	0.51	364	2.33	0.79	445	3.32	1.69	396	3.84	1.70
Total	690	1.90	0.56	1594	2.40	0.87	1566	3.18	1.42	1239	4.02	1.86
Age at Onset of Hearing Loss												
Onset of Hearing Loss at Birth	446	1.93	0.59	1071	2.41	0.87	1055	3.17	1.39	788	3.94	1.74
Onset of Hearing Loss After Birth	158	1.88	0.56	288	2.38	0.96	294	3.18	1.56	285	4.32	2.22
Unknown	86	1.81	0.40	235	2.36	0.73	217	3.21	1.42	166	3.86	1.66
Total	690	1.90	0.56	1594	2.40	0.87	1566	3.18	1.42	1239	4.02	1.86
Hearing Status of Parents												
At Least One Deaf Parent	50	1.95	0.38	107	2.69	0.89	109	3.67	1.52	74	4.56	1.90
No Deaf Parent(s)	466	1.92	0.62	941	2.44	0.88	961	3.22	1.40	847	4.12	1.91
Unknown	174	1.85	0.44	546	2.28	0.82	496	2.98	1.42	318	3.62	1.61
Total	690	1.90	0.56	1594	2.40	0.87	1566	3.18	1.42	1239	4.02	1.86
Degree of Hearing Loss (BEA)												
Less Than 85dB(ISO)	258	2.03	0.73	543	2.56	1.07	497	3.44	1.60	372	4.34	2.01
85dB & Greater (ISO)	304	1.83	0.40	771	2.30	0.68	768	3.05	1.36	696	3.89	1.76
Unknown	128	1.81	0.45	280	2.35	0.85	301	3.07	1.20	171	3.84	1.80
Total	690	1.90	0.56	1594	2.40	0.87	1566	3.18	1.42	1239	4.02	1.86
Non-Verbal I.Q.												
Less Than 96 I.Q.	140	1.64	0.34	460	2.12	0.66	505	2.71	1.14	397	3.19	1.33
96 & Greater I.Q.	249	1.94	0.49	519	2.62	0.97	548	3.55	1.43	471	4.73	1.98
Unknown	301	1.99	0.66	615	2.43	0.86	513	3.24	1.54	371	4.00	1.80
Total	690	1.90	0.56	1594	2.40	0.87	1566	3.18	1.42	1239	4.02	1.86
Additional Handicapping Conditions												
No Additional Handicapping Condition	463	1.93	0.55	991	2.53	0.90	958	3.35	1.40	806	4.37	1.92
At Least One Additional Handicapping Condition	137	1.74	0.42	388	2.11	0.75	396	2.69	1.15	289	3.13	1.43
Unknown	90	2.01	0.74	215	2.33	0.78	212	3.28	1.75	144	3.80	1.57
Total	690	1.90	0.56	1594	2.40	0.87	1566	3.18	1.42	1239	4.02	1.86

TABLE B: NUMBER, MEANS, AND STANDARD DEVIATION OF THE ARITHMETIC COMPUTATION SUB-TEST OF THE STANFORD ACHIEVEMENT TEST AS ADMINISTERED TO 8, 11, 14, AND 17 YEAR OLD HEARING IMPAIRED STUDENTS IN PARTICIPATING SPECIAL EDUCATIONAL PROGRAMS FOR THE HEARING IMPAIRED: UNITED STATES, 1970-71 SCHOOL YEAR.

	8 Year Old Students			11 Year Old Students			14 Year Old Students			17 Year Old Students		
	N	Mean	Stan Dev.	N	Mean	Stan. Dev.	N	Mean	Stan. Dev.	N	Mean	Stan. Dev.
Sex												
Male	339	1.82	0.56	842	2.84	1.34	833	4.37	2.13	677	6.10	2.51
Female	329	1.89	0.63	741	2.94	1.34	727	4.57	1.92	565	5.94	2.33
Unknown	0	–	–	0	–	–	0	–	–	0	–	–
Total	668	1.85	0.60	1583	2.88	1.34	1560	4.46	2.04	1242	6.03	2.43
Proportion of the School Day Spent in Special Educational Classes												
Full Time	595	1.79	0.53	1501	2.82	1.32	1469	4.39	2.01	1165	5.98	2.45
Part Time	73	2.38	0.86	82	4.00	1.35	91	5.68	2.00	77	6.72	2.02
Unknown	0	–	–	0	–	–	0	–	–	0	–	–
Total	668	1.85	0.60	1583	2.88	1.34	1560	4.46	2.04	1242	6.03	2.43
Type of Special Educational Program												
Students in Residential Programs	183	1.67	0.47	731	2.64	1.19	942	4.22	1.92	869	5.85	2.44
Students in Non-Residential Programs	485	1.92	0.63	852	3.10	1.43	618	4.84	2.15	373	6.43	2.36
Unknown	0	–	–	0	–	–	0	–	–	0	–	–
Total	668	1.85	0.60	1583	2.88	1.34	1560	4.46	2.04	1242	6.03	2.43
Age Beginning Formal Education												
Before 6 Yrs Old	486	1.85	0.55	871	2.90	1.38	688	4.87	2.04	507	6.51	2.40
6 Yrs. and After	68	1.91	0.83	353	2.64	1.22	430	3.73	1.75	339	5.46	2.32
Unknown	114	1.84	0.65	353	2.84	1.33	442	4.55	2.09	396	5.90	2.44
Total	668	1.85	0.60	1583	2.88	1.34	1560	4.46	2.04	1242	6.03	2.43
Age at Onset of Hearing Loss												
Onset of Hearing Loss At Birth	434	1.87	0.59	1064	2.93	1.36	1050	4.52	2.04	791	6.00	2.42
Onset of Hearing Loss After Birth	148	1.86	0.71	288	2.81	1.35	294	4.33	1.96	285	6.21	2.41
Unknown	86	1.76	0.41	231	2.75	1.24	216	4.40	2.12	166	5.84	2.48
Total	668	1.85	0.60	1583	2.88	1.34	1560	4.46	2.04	1242	6.03	2.43
Hearing Status of Parents												
At Least One Deaf Parent	49	1.96	0.51	106	3.53	1.40	110	5.10	1.98	74	6.93	2.44
No Deaf Parent(s)	447	1.87	0.63	935	2.93	1.33	955	4.63	2.04	850	6.14	2.42
Unknown	172	1.78	0.53	542	2.68	1.31	495	4.01	1.94	318	5.51	2.35
Total	668	1.85	0.60	1583	2.88	1.34	1560	4.46	2.04	1242	6.03	2.43
Degree of Hearing Loss(BEA)												
Less Than 85dB (ISO)	251	2.00	0.75	539	3.04	1.41	493	4.51	2.00	373	6.05	2.24
85dB & Greater (ISO)	294	1.76	0.46	764	2.78	1.25	765	4.41	2.08	698	6.05	2.42
Unknown	123	1.75	0.48	280	2.89	1.42	302	4.53	1.97	171	5.89	2.83
Total	668	1.85	0.60	1583	2.88	1.34	1560	4.46	2.04	1242	6.03	2.43
Non-Verbal I.Q.												
Less Than 96 I.Q.	134	1.55	0.42	456	2.37	1.09	502	3.51	1.64	398	4.78	2.02
96 & Greater I.Q.	239	1.89	0.51	517	3.27	1.40	546	5.34	1.88	472	7.11	2.32
Unknown	295	1.95	0.68	610	2.94	1.35	512	4.46	2.12	372	5.98	2.32
Total	668	1.85	0.60	1583	2.88	1.34	1560	4.46	2.04	1242	6.03	2.43
Additional Handicapping Conditions												
No Additional Handicapping Condition	450	1.87	0.60	988	3.07	1.38	957	4.82	1.99	809	6.58	2.27
At Least One Additional Handicapping Condition	129	1.72	0.60	384	2.43	1.16	391	3.61	1.84	289	4.52	2.19
Unknown	89	1.96	0.58	211	2.83	1.28	212	4.43	2.11	144	5.92	2.45
Total	668	1.85	0.60	1583	2.88	1.34	1560	4.46	2.04	1242	6.03	2.43

Guessing or "Chance" Level Responses on the Stanford Achievement Test, Hearing Impaired Students: United States, Spring 1971

Raymond J. Trybus and Peter J. Sepielli

INTRODUCTION

The results from the first National Achievement Testing Program conducted by the Office of Demographic Studies in spring, 1969, indicated that many students were being tested with battery levels beyond their ability, with many scores falling in the "chance" or "guessing" range as a result. The second National Achievement Testing Program, conducted in spring, 1971, utilized a screening test procedure as a basis for assignment of the battery level at which students were to be tested. This procedure was designed to reduce the incidence of guessing level scores and thereby increase the usefulness and accuracy of the resulting scores.

This study examines the results of the scores from the 1971 testing program in order to determine the frequency of occurrence of scores at or below the theoretical chance level and the likelihood that these scores did in fact result from performances indistinguishable from guessing. The question of guessing on standardized tests is a concern in all areas of testing with multiple-choice items, and it has been of interest in regard to the testing of hearing impaired students (Elliott and Healey, 1970). Since this question is of interest to so many teachers and other test-users, it can be of substantial value to have factual data in this regard for hearing impaired students.

The focus of this study is empirical and descriptive rather than theoretical. Nevertheless, because of the importance which the question of guessing has assumed, the following review of the literature will consider theoretical issues as well as empirical ones.

REVIEW OF THE LITERATURE

The question of guessing on achievement tests written in multiple-choice format has been a topic of consideration at least since McCall (1920) introduced a "correction for guessing" in his "new kind of school examination." Since then the debate on whether or not to correct for guessing or chance success has continued unabated, and studies of one or another sort relating to guessing have appeared regularly in the literature.

In terms of practical implications, the question of guessing has at least two major aspects:

(1) considerations regarding the degree to which guessing or random response has inflated resulting test scores across the score range, along with methods for correcting for this inflation; related concerns are the effects of guessing, and of correction-for-guessing formulas, on test reliability, validity, and item statistics; in these considerations guessing is taken to be one of several possible determinants of the answer marked by the examinee (Garvin, 1971), along with knowledge, partial knowledge, misinformation, response sets, etc.;

(2) considerations regarding the extent and frequency of guessing as a factor to be considered in

determining the appropriate testing level for tests with multiple difficulty levels; in this regard the concentration is on the extent of occurrence of scores whose sole or major component is guessing or chance.

This review of the related research will deal first with the considerations listed under (1), then move to the considerations under (2) as the concerns more directly relevant to this study.

An extensive review of the literature related to (1) above has appeared recently (Diamond & Evans, 1973), and as a result only brief mention will be made here of this area of concern.

The correction-for-guessing formula is

$$R - \frac{W}{N-1} = S_c,$$

where S_c is the corrected score, R is the number of items answered correctly, W is the number of items answered incorrectly, and N is the number of response options per item. While use of the formula will mean lower absolute scores on an achievement test, Stanley (1954) and Ebel (1965) pointed out that the rank ordering of a group of students by means of corrected and uncorrected scores will approach identity as the number of items omitted by each student approaches a constant value. Jackson (1955) found that a "rights-only" score and three different corrected scores all had approximately the same correlation with two estimates of the student's "true score," and he concluded that the simplicity of the "rights-only" score made it the most appropriate choice. Little and Creaser (1966) showed that items about which the student was uncertain were more often correct than wrong, and that therefore it is unfair to penalize students for guessing. Creaser and Little (1967) found that formula-corrected scores had a higher correlation with a "rights-only" score than with the "pure knowledge" score at which the correction is presumably directed. They conclude that while correction formulas might be used appropriately for some purposes, the corrected scores do not yield the approximation to "pure knowledge" scores for which they are generally intended. Lyerly (1951), on the other hand, asserted that the usual correction formula yields a close approximation to the maximum likelihood estimate of an individual's "true score," assuming that the student either "knows" or "does not know" the answer and assuming that all guessing is completely random.

In the actual test situation, of course, guessing is rarely completely random, and this fact leads to considerations of the possibility of overcorrecting or undercorrecting, depending on the individual test-taker's propensity to guess when in doubt. Slakter (1968) suggested that instructions and formulas designed to reduce guessing are differentially unfair to those students who are more cautious and less prone to mark an answer when in doubt, even though in fact the element of doubt may be minimal. This fact introduces a new source of variance into the test scores related to the student's personality and/or his test-taking sophistication and strategy rather than to the variable being measured; this constitutes an additional source of error variance. On the other hand, Lord (1964) indicated that instructions to finish all items result in forced random guessing, which also produces an increase in error variance and a consequent decrease in validity. Cureton (1966) argued that correction formulas erase the effects of consistent individual differences in response to test items, thus lowering reliability. Hanna (1970) argued that scoring only for the number right rewards examinees who violate the usual instructions to avoid wild guesses, but to answer if there is a hunch or other state of uncertainty. In a theoretical article, Mattson (1965) indicated that guessing reduces reliability even if it also reduces the standard error of measurement. Frary (1969) summarized:

> . . . no very satisfactory method [of reducing or eliminating the guessing component] has been found within the conventional multiple-choice test format. . . . For many situations, . . . eliminating the guessing component of scores would increase reliability only at the greater expense of reducing validity. (p. 679)

Let us now turn our attention to the second consideration above, in which the actual extent of guessing behavior resulting in scores largely determined by chance is in question. Ebel (1968) found that from three to eight percent of the responses to four different tests were based on blind guessing as determined from students' self-reports. He also discovered that on items indicated to be blind guesses, the proportion answered correctly was only very slightly better than chance. Sax (1962) addressed himself to the issue of the normative equivalents provided in standardized tests for raw scores which could be obtained by chance. He reported, for example, the case of an I.Q. test intended for persons 11 years old and older. If an 11 year old student were to take this test, answering on the basis of chance alone, his chance raw score would be equal to an I.Q. of 116 and a percentile rank of 80 according to the normative tables for the test. In this article, Sax reviewed the normative score equivalents of chance level raw scores on a number of standardized I.Q. and achievement tests, and suggested, "The test manual should report the proportion of the standardization group which does no better than chance and the standard deviation of chance scores" (p. 573). This same point has been raised by Elliott and Healey (1970) in relation to the selection of test levels for achievement testing of hearing impaired students. Grade equivalent scores based on raw scores which are at or below the theoretical chance level of the test cannot be accepted as meaningful unless it is clear that the student has omitted most of the test items and obtained a percent correct which is well above the chance level on the remaining

items which he has answered. While scores at or below chance level are not useful for determination of a student's academic status, they may still be of value for predictive purposes. Cliff (1958) investigated the predictive ability of chance-level scores on the Cooperative School and College Ability Tests and found that with some tests, chance level scores are as predictive of a criterion as are non-chance scores. Nevertheless, this is not a general conclusion, and the possible predictive value of such chance scores must be investigated under the specific conditions of use of a specific test.

The focus of the present study is on the rates of occurrence of chance-level scores on the sub-tests of the Stanford Achievement Test administered to hearing impaired students and on the extent to which such scores actually indicate performance indistinguishable from guessing or chance responding.

METHOD

Subjects in the National Testing Program

During the spring of 1971 the Office of Demographic Studies conducted a National Achievement Testing Program for hearing impaired students. Every educational program for hearing impaired students then known to the Office was invited to participate. The invitation went to 776 programs, of which 292 finally participated and administered over 19,000 individual achievement tests. Since participation in the achievement testing program was determined by voluntary cooperation of the programs rather than by sampling on a systematic basis, the resulting group of students, while large, cannot be called representative on the basis of sampling methodology. Post-hoc analysis of the demographic composition of the group of students who were tested, however, suggests that this group is quite comparable to the untested group on all variables except age, where differences are to be expected since younger students are not ordinarily tested by means of achievement tests. Students in the 0-9 age group constituted 14.8 percent of the tested group, compared to 62.0 percent of the untested group; of all students in the Annual Survey, 42.6 percent fell into this 0-9 age range. The demographic data appear in Appendix I. An overall statement of the qualifications and limitations of all data arising from the 1971 testing program appears in this publication as Appendix II.

Subjects in This Study

A demographic data file was available for 16,908 of the 19,037 students tested in the 1971 program. From this group of 16,908 students, those individuals were selected whose raw score on a given sub-test was at or below the raw score to be expected on the basis of random response or guessing, with each alternative having an equal probability of being chosen. Table 1 lists the raw scores required for inclusion

TABLE 1: RAW SCORE MEANS AND STANDARD DEVIATIONS OF THE DISTRIBUTIONS OF CHANCE OR GUESSING LEVEL SCORES ON SUB-TESTS OF THE STANFORD ACHIEVEMENT TEST.

Sub-test	Primary I		Primary II		Intermediate I		Intermediate II		Advanced	
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
Word Reading/ Word Meaning	9	2.6	9	2.6	9	2.7	12	3.0	*	*
Paragraph Meaning	9	2.7	15	3.4	15	3.4	16	3.5	15	3.4
Vocabulary/Science & Social Studies Concepts	13	2.9	13	2.9	*	*	*	*	*	*
Spelling	**	**	**	**	13	3.1	14	3.2	15	3.3
Word Study Skills	19	3.5	19	3.6	18	3.6	*	*	*	*
Language	*	*	28	4.2	46	5.3	49	5.5	51	5.6
Arithmetic Computation	*	*	**	**	8	2.5	8	2.5	8	2.6
Arithmetic Concepts	**	**	**	**	8	2.4	8	2.4	10	2.7
Arithmetic Applications	*	*	*	*	7	2.3	8	2.5	7	2.4
Social Studies	*	*	*	*	12	3.0	19	3.7	23	4.2
Science	*	*	*	*	14	3.2	15	3.3	15	3.4

*This sub-test is not included in this battery.

**This sub-test is not in multiple-choice format.

in this study (i.e., the mean number of correct responses to be expected by chance), and also, in accordance with Sax's (1962) suggestion, the standard deviation of the distribution of chance scores for each sub-test included in this study. Those sub-tests not in multiple-choice format were not included.

TABLE 2: NUMBERS AND PERCENTAGES OF HEARING IMPAIRED STUDENTS RECEIVING SUB-TESTS, OBTAINING GUESSING LEVEL SCORES, AND PROBABLY GUESSING.

N.B.: Columns 1 thru 7 in this table represent the following:

① Number of students taking the sub-test
② Number of students receiving guessing level scores
③ Number of students in the sample studied
④ Number of students in the sample as a percent of the total number of students taking the sub-test and obtaining a chance score
⑤ Percent of total number of students receiving guessing level scores
⑥ Percent of total number of students who received guessing level scores for reasons other than guessing or random response
⑦ Percent of total number of students who were probably guessing or responding randomly

	①	②	③	④	⑤	⑥	⑦
Primary I							
Word Reading	5793	284	57	20.1%	4.9%	0.5%	4.4%
Paragraph Meaning	5923	499	51	10.2	8.4	1.0	7.4
Vocabulary	5625	2644	51	1.9	47.0	1.9	45.1
Word Study Skills	1723	231	57	24.7	13.4	5.9	7.5
Primary II							
Word Meaning	5914	688	49	7.1%	11.6%	2.3%	9.3%
Paragraph Meaning	5913	209	52	24.9	3.5	0.3	3.2
Science/Social Studies	5608	2058	51	2.5	36.7	0.7	36.0
Word Study Skills	1672	443	51	11.5	26.5	9.9	15.6
Language	5800	436	51	11.7	7.5	1.0	6.5
Intermediate I							
Word Meaning	2817	402	49	12.2%	14.3%	3.9%	10.4%
Paragraph Meaning	2817	237	45	19.0	8.4	2.0	6.4
Spelling	2745	54	50	92.6	2.0	0.3	1.7
Word Study Skills	1253	279	47	16.8	22.3	2.0	20.3
Language	2808	58	54	93.1	2.1	0.2	1.9
Arithmetic Computation	2812	53	50	94.3	1.9	0.7	1.2
Arithmetic Concepts	2812	322	47	14.6	11.5	1.3	10.2
Arithmetic Applications	2810	353	45	12.7	12.6	0.5	12.1
Social Studies	2790	54	50	92.6	1.9	0.2	1.7
Science	2781	66	57	86.4	2.4	0.3	2.1
Intermediate II							
Word Meaning	1439	274	248	90.5%	19.0%	3.6%	15.4%
Paragraph Meaning	1436	88	70	79.5	6.1	1.2	4.9
Spelling	1410	26	23	88.5	1.8	0.3	1.5
Language	1438	24	18	75.0	1.7	0.2	1.5
Arithmetic Computation	1437	65	58	89.2	4.5	1.5	3.0
Arithmetic Concepts	1437	215	189	87.9	15.0	0.9	14.1
Arithmetic Applications	1432	107	91	85.0	7.5	1.0	6.5
Social Studies	1428	25	22	88.0	1.8	0.5	1.3
Science	1421	101	86	85.1	7.1	0.8	6.3
Advanced							
Paragraph Meaning	726	56	38	67.9%	7.7%	1.0%	6.7%
Spelling	715	33	21	63.6	4.6	0.6	4.0
Language	725	10	8	80.0	1.4	0.2	1.2
Arithmetic Computation	724	32	27	84.4	4.4	2.1	2.3
Arithmetic Concepts	720	65	50	76.9	9.0	1.2	7.8
Arithmetic Applications	716	78	53	67.9	10.9	0.4	10.5
Social Studies	715	55	39	70.9	7.7	0.2	7.5
Science	716	23	18	78.3	3.2	0.7	2.5

For sub-tests of the Advanced and Intermediate II batteries, all individuals identified in this manner constituted the sample for this study. For sub-tests of the Primary I, Primary II, and Intermediate I batteries a sample of approximately 50 was chosen for each sub-test separately by selecting every *n*th individual, *n* being determined for each sub-test so as to yield a sample of approximately 50. By this procedure a total of 2,365 cases of individuals having a low score on a given sub-test was identified. The original test forms for these 2,365 individuals were then located from storage files. Since not all the booklets were returned to this Office by the scoring center (the unreturned booklets long since having been destroyed), a total of 2,075 forms was actually located, for 87.74 percent of the total. These 2,075 records provided the data for this study. Columns 1-4 of Table 2 list the number of students taking each sub-test of each battery in the national program, the number of low scores selected in the manner described above, the number of cases located and used in this study, and the number of cases located as a percentage of the number of low scores for the given sub-tests. Columns 5, 6, and 7 of Table 2 will be referred to later.

Procedure

Once the actual test forms were located, the following procedures were employed. First, the number of items actually attempted by the given student on the given sub-test was determined from the test form ("attempted" was defined as the presence of one or more marks in the answer spaces for the item in question). Second, of these attempted items the number which were correct was determined. Third, the percent of items answered correctly was calculated using the number of items attempted as the base. Thus, on a 60-item test, if 45 items were attempted and 15 were correct, the percent of correct responses was 33 percent. This procedure provides a measure of the likelihood of guessing by the given individual. Consider two students who both take the same 60-item multiple-choice test, in which each item has four possible responses. Each student obtains a raw score of 15 items correct. Student A has attempted only 15 items and has answered all correctly. His percentage as determined above is 100 percent and it is extremely unlikely that this score was obtained solely by chance or random guessing. Student B, in contrast, has attempted all 60 items and answererd 15 correctly, interspersed throughout the test. His performance, with a rate of 25 percent correct answers, is indistinguishable from guessing or random response.

In any group of test-takers who guess completely at random, not all would obtain exactly 25 percent of the items correct, assuming items with four response choices. The guessing scores would be distributed around that figure as a mean. The standard deviations of these distributions of chance scores have been listed in Table 1. Conversion of these raw score standard deviations to percent correct scores shows that the resulting range of standard deviations in percent notation ranges from a low of four percent to a high of seven percent for various sub-tests. For the sake of simplicity, the figure of five percent was used as an estimate of the standard deviation in every case. In determining whether the percent correct score for an individual did or did not suggest the likelihood of guessing on the part of the student in question, this estimated standard deviation of five percent was added to the overall expected chance rate of success so as to consider as having guessed any individual whose percent correct score ranged up to one standard deviation above the mean of chance scores. For example, if the expected percent correct by chance for a given sub-test is 25 percent, this was increased by five percent to 30 percent. Any individual with a percent correct score up to and including 30 percent was then considered to have a performance indistinguishable from guessing or random response. This procedure should account for correct identification of 85 percent of all students whose performance was in fact based on guessing. About 15 percent of those who were actually guessing or responding randomly would fail to be so labeled by this procedure, so that the resulting estimates of rate of guessing will tend to err slightly in a conservative direction. Gulliksen (1950) has suggested the use of a two standard deviation figure in situations similar to this, but the one standard deviation method used here appears sufficiently precise for the intended purpose.

RESULTS

The results from the samples studied are presented in Tables 3-A through 3-M, according to the sub-test involved, across the five batteries. The first line of each table gives the average percent of items attempted by the low-score group. The second line of the table gives the average percent of items attempted which were answered correctly by this group of students. The third line of the table lists the percent of individuals in the sample studied who were probably guessing as determined by the "mean + five percent" rule described above.

Further implications of these results are presented in columns 5 through 7 of Table 2. Column 5 indicates the percent of the total number of students taking a given sub-test who obtained low raw scores at or below the theoretical chance level. Column 7 indicates the percent of the total number of students taking a given sub-test who were probably guessing or whose performance is indistinguishable from random responding. The figures in column 7 were obtained by multiplying the percent given in column 5 by the appropriate "percent guessing" from Table 3. For example, for the Primary I Word Reading Subtest, Table 3-A indicates that 89 percent of those with guessing level raw scores were probably guessing.

TABLE 3: MEAN PERCENT OF ITEMS ATTEMPTED, MEAN PERCENT OF ATTEMPTED ITEMS ANSWERED CORRECTLY, AND MEAN PERCENT OF GUESSING STUDY STUDENTS PROBABLY GUESSING, FOR SUB-TESTS ACCORDING TO BATTERY LEVEL OF STANFORD ACHIEVEMENT TEST.

	Primary I	Primary II	Intermediate I	Intermediate II	Advanced
3–A: Word Reading/ Word Meaning Sub-test					
Mean Percent of Items Attempted	89	86	76	84	*
Mean Percent Correct of Items Attempted	19	24	24	24	*
Percent Correct To Be Expected By Chance	25	25	25	25	*
Mean Percent of Low-score Students Guessing	89	80	73	81	*
3–B: Spelling Sub-test					
Mean Percent of Items Attempted	**	**	90	87	89
Mean Percent Correct of Items Attempted	**	**	22	25	25
Percent Correct To Be Expected By Chance	**	**	25	25	25
Mean Percent of Low-score Students Guessing	**	**	88	83	86
3–C: Language Sub-test					
Mean Percent of Items Attempted	*	89	91	72	94
Mean Percent Correct of Items Attempted	*	35	37	43	34
Percent Correct To Be Expected By Chance	*	37	38	37	35
Mean Percent of Low-score Students Guessing	*	86	93	89	88
3–D: Social Studies Sub-test					
Mean Percent of Items Attempted	*	*	94	86	94
Mean Percent Correct of Items Attempted	*	*	24	28	22
Percent Correct To Be Expected By Chance	*	*	25	25	25
Mean Percent of Low-score Students Guessing	*	*	88	72	97
3–E: Science Sub-test					
Mean Percent of Items Attempted	*	*	88	93	99
Mean Percent Correct of Items Attempted	*	*	22	24	23
Percent Correct To Be Expected By Chance	*	*	25	25	25
Mean Percent of Low-score Students Guessing	*	*	88	88	78
3–F: Paragraph Meaning Sub-test					
Mean Percent of Items Attempted	84	90	85	87	90
Mean Percent Correct of Items Attempted	22	23	25	11	24
Percent Correct To Be Expected By Chance	25	25	25	25	25
Mean Percent of Low-score Students Guessing	88	90	76	80	87
3–G: Word Study Skills Sub-test					
Mean Percent of Items Attempted	57	65	93	*	*
Mean Percent Correct of Items Attempted	34	32	26	*	*
Percent Correct To Be Expected By Chance	33	30	30	*	*
Mean Percent of Low-score Students Guessing	56	59	91	*	*
3–H: Arithmetic Computation Sub-test					
Mean Percent of Items Attempted	*	**	77	70	60
Mean Percent Correct of Items Attempted	*	**	23	21	24
Percent Correct To Be Expected By Chance	*	**	20	20	20
Mean Percent of Low-score Students Guessing	*	**	62	66	52
3–K: Arithmetic Concepts Sub-test					
Mean Percent of Items Attempted	**	**	94	100	84
Mean Percent Correct of Items Attempted	**	**	23	22	24
Percent Correct To Be Expected By Chance	**	**	25	25	25
Mean Percent of Low-score Students Guessing	**	**	89	94	86
3–L: Arithmetic Applications Sub-test					
Mean Percent of Items Attempted	*	*	97	96	90
Mean Percent Correct of Items Attempted	*	*	19	17	17
Percent Correct To Be Expected By Chance	*	*	20	20	20
Mean Percent of Low-score Students Guessing	*	*	96	87	96
3–M: Vocabulary/Science & Social Studies Sub-test					
Mean Percent of Items Attempted	95	100	*	*	*
Mean Percent Correct of Items Attempted	30	28	*	*	*
Percent Correct To Be Expected By Chance	33	33	*	*	*
Mean Percent of Low-score Students Guessing	96	98	*	*	*

* This sub-test is not included in this battery.
**This sub-test is not in multiple-choice format.

Multiplying this by the figure in column 5 (4.9 percent), yields the figure reported in column 7, namely 4.4 percent. Column 6 gives the difference between the figures in columns 5 and 7. The column 6 figures represent the percent of the total number of students taking the given sub-test who obtained guessing level raw scores for reasons other than guessing or random response. While these reasons cannot be known in any definitive sense, the major reasons probably involve expiration of time limits, avoidance of items which appear too difficult to the test-taker, or withholding response because of doubt as to the correct answer.

From the perspective of the main question posed in this study, column 7 contains the most significant data. The percentages in this column represent the percentage of students who — on the basis of the assumptions which lie behind this study — obtained too high a score on the basis of guessing.

DISCUSSION

Examination of the results indicates, first, that fewer than 10 percent of the students tested were probably guessing on 26 of the 36 sub-tests studied: and, second, guessing level raw scores were apparently the result of guessing in the overwhelming majority of cases, with the exception of Word Study Skills at the Primary levels and Arithmetic Computation at the Intermediate and Advanced levels, in which cases only about one-half to two-thirds of the low scores were related to guessing. Guessing is a serious problem on only four sub-tests: Primary II Word Study Skills, Intermediate I Word Study Skills, Primary II Science and Social Studies Concepts, and Primary I Vocabulary. The first two of these are inappropriate for testing hearing impaired children because of the very nature of the items, which require comparisons of sounds, etc. The Annual Survey recommended that these sub-tests *not* be used, and the data given here are based on those programs which did use these tests despite the recommendation. The other two sub-tests were revised to Form W-H1 for the 1970-71 testing program by printing into the student's test booklet the text of items which are dictated in the original version of the test. While this apparently assists some students, it has the drawback of being written language which is above the average reading level of the hearing impaired student. These items, dictated by the teacher, are appropriately comprehensible to hearing students. In written form, the language is beyond that of hearing impaired students taking the given battery and very possibly beyond that of the hearing students in the standardization sample as well. This may very well be a major factor underlying the high proportions of guessing in these two sub-tests.

With the exceptions noted above, then, guessing does not appear to be a major problem in the National Achievement Testing Program conducted in 1970-71. The question of guessing is very largely related to the issue of testing at appropriate levels of difficulty and content coverage; the likelihood of guessing increases substantially if the student is tested with a battery which is beyond his present range of academic ability. The present results were obtained on a national basis in a program in which the assignment of testing batteries to students was based on a careful screening test procedure which has been described elsewhere.[1] They represent a significant improvement over the first National Achievement Testing Program conducted by the Office of Demographic Studies in 1969. In that earlier program the screening test procedure was not used, and the proportions of scores in the guessing range were significantly higher.

Since the purpose of norm-referenced tests such as the Stanford Achievement Test is to differentiate among achievement levels in a group of students, since the extent of guessing as determined by this study is not of major proportions, and since the available data (e.g., Jackson, 1955) indicate that scores corrected for guessing have a high positive correlation with uncorrected scores based simply on the number of correct answers, it is concluded that the usefulness of the Stanford Achievement Test with hearing impaired students is not significantly impaired by the factor of guessing on the part of the test-taking students.

[1]See *Academic Achievement Test Results of a National Testing Program for Hearing Impaired Students, United States: Spring 1971*. Gallaudet College, Office of Demographic Studies, Series D, Number 9.

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Intercorrelations Among the Sub-Tests of the Stanford Achievement Test, Hearing Impaired Students: United States, Spring 1971

Raymond J. Trybus

INTRODUCTION

One of the technical considerations in the design of an achievement test is the extent to which the various sub-tests which make up a test battery are correlated with each other. While there are no hard and fast rules, it is generally desirable that such sub-test intercorrelations be low and positive. When this is the case, the correlations constitute evidence that the various sub-tests are in fact measuring different areas of knowledge which are more or less independent. High positive intercorrelations, on the other hand, do not necessarily negate the value of the correlated measures, since all human performances tend to have some positive intercorrelation and since other considerations of curriculum coverage and the logical divisions of academic subject matter enter into test design as well. Nevertheless, low correlation figures lend added weight to claims regarding the distinctness or independence of various subject matter fields.

This study examines the intercorrelations among all the sub-tests of all five batteries of the Stanford Achievement Test used in the Spring 1971 National Testing Program conducted by the Office of Demographic Studies and involving special educational programs serving hearing impaired students. The data are presented in three sections: first, the figures for hearing impaired students, regardless of age, are presented along with the comparable figures for the standardization group;[1] second, the figures for the hearing impaired students are presented according to the age of the students; finally, the average intercorrelations of each sub-test with other sub-tests in the same battery are examined, with a view to the selection of a screening test required for testing hearing impaired students. These data are subject to the same cautions and limitations which apply to all data derived from the 1971 testing program. Appendix II describes these limitations in detail. The intercorrelations reported for the hearing standardization sample were obtained from the Technical Supplement for the Stanford tests[2] and are based on results obtained with Form X of the tests. As such, they are not directly comparable to the correlations reported here for Form W, but the similarity of content, format, and psychometric characteristics of the two forms suggests that the differences between them in intercorrelation coefficients would be very small; and the reported figures are therefore useful for general comparisons such as those intended here.

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[1]The term "standardization group" used throughout this paper refers to the national sample of normally hearing students on whom the normative data for the Stanford test are based.

[2]Kelley, T.L., Madden, R., Gardner, E. F., and Rudman, H. C. *Stanford Achievement Test Technical Supplement*. New York: Harcourt, Brace & World, Inc., 1966, pp. 16-18.

TABLE 1: MEAN AND MEDIAN INTERCORRELATIONS FOR THE FIVE BATTERIES OF THE STANFORD ACHIEVEMENT TEST FOR HEARING IMPAIRED AND STANDARDIZATION GROUP STUDENTS: UNITED STATES, SPRING 1971.

Battery	Hearing Impaired		Standardization Group	
	Mean	Median	Mean	Median
Primary I*	.46	.46	.63	.63
Primary II**	.45	.48	.65	.67
Intermediate I***	.50	.50	.69	.70
Intermediate II****	.53	.53	.70	.71
Advanced*****	.61	.62	.68	.69

*Standardization Group figures are based on Grade 1 students.
**Standardization Group figures are based on Grade 3 students.
***Standardization Group figures are based on Grade 4 students.
****Standardization Group figures are based on Grade 6 students.
*****Standardization Group figures are based on Grade 9 students.

TABLE 2: INTERCORRELATION MATRIX FOR THE PRIMARY I BATTERY, STANFORD ACHIEVEMENT TEST, FOR HEARING IMPAIRED AND STANDARDIZATION GROUP STUDENTS.

Test	Arithmetic	Word Study Skills	Spelling	Vocabulary	Paragraph Meaning
Word Meaning	.58*	.44	.65	.28	.78
	.60**	.73	.73	.55	.72
Paragraph Meaning	.58	.46	.59	.30	
	.60	.67	.71	.50	
Vocabulary	.34	.23	.25		
	.63	.61	.49		
Spelling	.46	.50			
	.59	.72			
Word Study Skills	.44				
	.66				

*In each case the upper figure is that for the hearing impaired group (N ≈5900).
**In each case the lower figure is that for the standardization group (N ≈1000). These figures are reproduced from Stanford Achievement Test, copyright © 1964-66 by Harcourt Brace Jovanovich, Inc. Reproduced by permission.

INTERCORRELATIONS FOR THE HEARING IMPAIRED AND THE STANDARDIZATION GROUPS

Table 1 reports the mean and median intercorrelations for the five batteries for both the hearing impaired and the standardization groups. Tables 2 through 6 report the intercorrelations for all the subtests of all batteries, for both the hearing impaired and the standardization groups.

From inspection of these tables it is apparent that the correlations are generally lower for the hearing impaired group. The overall average correlation for the hearing impaired group (unweighted) is .51; the corresponding figure for the standardization group is .67. The evidence, then, suggests that the various academic tasks of reading, figuring, etc., are somewhat more independent forms of knowledge among the hearing impaired students than is the case among the standardization group students. The data in Table 1 also indicate a trend for the average intercorrelation to increase from the lower to the upper batteries for hearing impaired students. A similar trend exists in the standardization group data, but to a lesser degree. Expressed another way, this suggests that knowledges which tend to be separate and independent in the earlier years of academic training begin to become more integrated as the individual progresses academically.

TABLE 3: INTERCORRELATION MATRIX FOR THE PRIMARY II BATTERY, STANFORD ACHIEVEMENT TEST, FOR HEARING IMPAIRED AND STANDARDIZATION GROUP STUDENTS.

Test	Arithmetic Concepts	Arithmetic Computation	Language	Word Study Skills	Spelling	Science & Social Studies	Paragraph Meaning
Word Meaning	.52*	.39	.54	.36	.50	.51	.67
	.70**	.53	.74	.69	.72	.66	.83
Paragraph Meaning	.60	.48	.65	.38	.53	.48	
	.73	.57	.78	.73	.76	.62	
Science & Social Studies Concepts	.49	.36	.44	.23	.33		
	.64	.46	.57	.54	.46		
Spelling	.38	.38	.55	.21			
	.63	.54	.71	.69			
Word Study Skills	.35	.18	.27				
	.68	.53	.70				
Language	.60	.52					
	.70	.56					
Arithmetic Computation	.67						
	.67						

*In each case the upper figure is that for the hearing impaired group (N ≈5900).
**In each case the lower figure is that for the standardization group (N ≈1000). These figures are reproduced from Stanford Achievement Test, copyright © 1964-66 by Harcourt Brace Jovanovich, Inc. Reproduced by permission.

TABLE 4: INTERCORRELATION MATRIX FOR THE INTERMEDIATE I BATTERY, STANFORD ACHIEVEMENT TEST, FOR HEARING IMPAIRED AND STANDARDIZATION GROUP STUDENTS.

Test	Social Studies	Science	Arithmetic Applications	Arithmetic Concepts	Arithmetic Computation	Language	Word Study Skills	Spelling	Paragraph Meaning
Word	.49*	.54	.44	.42	.28	.54	.37	.52	.62
Meaning	.78**	.73	.63	.61	.50	.75	.71	.70	.82
Paragraph	.61	.63	.55	.49	.32	.61	.42	.53	
Meaning	.82	.77	.70	.67	.57	.79	.73	.74	
Spelling	.51	.49	.46	.44	.45	.66	.34		
	.68	.64	.60	.55	.53	.76	.74		
Word Study	.33	.38	.36	.33	.18	.45			
Skills	.72	.80	.65	.64	.59	.80			
Language	.61	.58	.60	.56	.46				
	.76	.72	.70	.69	.64				
Arithmetic	.49	.32	.62	.64					
Computation	.57	.55	.66	.63					
Arithmetic	.66	.50	.77						
Concepts	.64	.70	.74						
Arithmetic	.69	.58							
Applications	.71	.72							
Science	.67								
	.80								

*In each case the upper figure is that for the hearing impaired group (N ≈2800).

**In each case the lower figure is that for the standardization group (N ≈1000). These figures are reproduced from Stanford Achievement Test, copyright © 1964-66 by Harcourt Brace Jovanovich, Inc. Reproduced by permission.

TABLE 5: INTERCORRELATION MATRIX FOR THE INTERMEDIATE II BATTERY, STANFORD ACHIEVEMENT TEST, FOR HEARING IMPAIRED AND STANDARDIZATION GROUP STUDENTS.

Test	Social Studies	Science	Arithmetic Applications	Arithmetic Concepts	Arithmetic Computation	Language	Spelling	Paragraph Meaning
Word	.54*	.63	.45	.37	.26	.56	.56	.64
Meaning	.77**	.77	.70	.69	.55	.76	.70	.83
Paragraph	.61	.70	.51	.40	.28	.56	.48	
Meaning	.80	.81	.74	.72	.61	.80	.70	
Spelling	.52	.41	.47	.39	.46	.68		
	.53	.58	.60	.56	.59	.76		
Language	.60	.53	.56	.51	.51			
	.70	.77	.74	.73	.68			
Arithmetic	.50	.26	.69	.67				
Computation	.52	.59	.70	.68				
Arithmetic	.56	.41	.76					
Concepts	.77	.69	.84					
Arithmetic	.68	.53						
Applications	.72	.79						
Science	.66							
	.80							

*In each case the upper figure is that for the hearing impaired group (N ≈1400).

**In each case the lower figure is that for the standardization group (N ≈1000). These figures are reproduced from Stanford Achievement Test, copyright © 1964-66 by Harcourt Brace Jovanovich, Inc. Reproduced by permission.

TABLE 6: INTERCORRELATION MATRIX FOR THE ADVANCED BATTERY, STANFORD ACHIEVEMENT TEST, FOR HEARING IMPAIRED AND STANDARDIZATION GROUP STUDENTS.

Test	Social Studies	Science	Arithmetic Applications	Arithmetic Concepts	Arithmetic Computation	Language	Spelling
Paragraph	.80*	.72	.58	.56	.39	.73	.60
Meaning	.77**	.84	.69	.72	.68	.78	.60
Spelling	.63	.49	.48	.57	.53	.75	
	.38	.55	.45	.54	.58	.70	
Language	.76	.63	.61	.66	.59		
	.65	.77	.66	.74	.74		
Arithmetic	.47	.40	.61	.75			
Computation	.55	.68	.70	.81			
Arithmetic	.67	.60	.75				
Concepts	.67	.76	.75				
Arithmetic	.71	.61					
Applications	.65	.71					
Science	.77						
	.80						

*In each case the upper figure is that for the hearing impaired group (N ≈725).

**In each case the lower figure is that for the standardization group (N ≈1000). These figures are reproduced from Stanford Achievement Test, copyright © 1964-66 by Harcourt Brace Jovanovich, Inc. Reproduced by permission.

TABLE 7: AGE RANGES IN YEARS* AND NUMBERS OF STUDENTS** FOR THE INTERCORRELATION MATRICES FOR HEARING IMPAIRED STUDENTS, BY AGE GROUP.

	Age Group 1		Age Group 2		Age Group 3		Age Group 4	
Battery	N	Age Range	N	Age Range	N	Age Range	N	Age Range
Primary I	1352	8 & Under	1485	9-10	1670	11-12	1411	13+
Primary II	1551	11 & Under	1848	12-13	1658	14-16	860	17+
Intermediate I	654	13 & Under	801	14-15	730	16-17	631	18+
Intermediate II	306	14 & Under	425	15-16	486	17-18	221	19+
Advanced	134	15 & Under	287	16-17	173	18	131	19+

*All ages were computed as of December 31, 1970. The four age groups were selected so as to minimize the variation in size of the groups, while maintaining whole-year age groups (i.e., age groups bounded by fractional ages were not used).

**The N's reported here are maximum possible N's; i.e., the reported N is the greatest N observed for any correlation in the matrix for the given battery. The N's for some of the correlations are lower than this maximum due to incomplete test batteries, absence of some students on one or another day of testing, etc.

INTERCORRELATIONS FOR THE HEARING IMPAIRED GROUPS, BY AGE

In order to determine the influence of the age of hearing impaired students on the intercorrelations observed among their sub-test scores, the group of students receiving each of the five battery levels was divided into four age groups in such a way as to minimize the variation of numbers of students assigned to each of the four groups. All ages were computed as of December 31, 1970, and only whole-year ages were considered in group assignment. Table 7 presents the age ranges in years for each of the four age groups for each of the five battery levels, along with the number of students falling into each category.

The intercorrelations obtained for the four age groups for each of the five battery levels are presented in Tables 8 through 12. In each cell of the table, the top figure is for the youngest age group, the second figure for the next oldest group, and so on to the figure for the oldest age group at the bottom of the cell.

Examination of these tables indicates the presence of some age trends for hearing impaired students, but these trends are complex and do not hold in every individual case. Overall, for the Primary I battery the trend is to lower correlations as age increases. Twelve out of fifteen correlations decreased across age groups, with an average decrease of .09. For the Primary II battery, 21 out of 28 correlations show a decrease across age groups, with the average decrease being .06. In the Intermediate I battery 22 out of 45 correlations show a decrease, and the resulting mean change shows a decrease of less than .01 as age increases. In the Intermediate II battery, 26 out of 36 correlations decrease across age, with a mean change of .04. In the Advanced battery the situation is reversed, with 24 out of 28 correlations showing an increase as age increases, with a mean increase of .06 from the youngest to the oldest group.

While the available figures for the hearing standardization group are based on different age groups, the pattern seems to be one of increasing correlations as age increases. For the Primary II standardization group the mean correlation rises from .58 to .65 between Grade 2 and Grade 3. For the Intermediate II battery the rise is from .66 to .70 between Grade 2

TABLE 8: INTERCORRELATION MATRIX FOR THE PRIMARY I BATTERY, STANFORD ACHIEVEMENT TEST, FOR HEARING IMPAIRED STUDENTS, BY AGE GROUP.

Test	Arithmetic	Word Study Skills	Spelling	Vocabulary	Paragraph Meaning
Word Meaning	.58*	.57	.68	.27	.79
	.52*	.46	.66	.21	.77
	.46*	.46	.59	.23	.75
	.51*	.27	.56	.34	.77
Paragraph Meaning	.59	.54	.65	.29	
	.53	.47	.61	.24	
	.54	.51	.54	.26	
	.55	.28	.48	.36	
Vocabulary	.34	.27	.24		
	.34	.31	.27		
	.34	.23	.20		
	.32	.11	.28		
Spelling	.47	.53			
	.46	.54			
	.42	.50			
	.34	.41			
Word Study Skills	.50				
	.48				
	.43				
	.34				

*In each cell of this table, the topmost correlation figure is that for the 8 year old and under group; the second is for the 9-10 year old group; the third is for the 11-12 year old group; and the bottom-most figure is for students 13 years old and up.

TABLE 9: INTERCORRELATION MATRIX FOR THE PRIMARY II BATTERY, STANFORD ACHIEVEMENT TEST, FOR HEARING IMPAIRED STUDENTS, BY AGE GROUP.

Test	Arithmetic Concepts	Arithmetic Computation	Language	Word Study Skills	Spelling	Science & Social Studies	Paragraph Meaning
Word Meaning	.55*	.39	.52	.43	.51	.48	.68
	.51*	.40	.54	.34	.53	.50	.68
	.50*	.38	.55	.35	.47	.50	.67
	.50*	.35	.55	.38	.39	.56	.63
Paragraph Meaning	.63	.48	.65	.45	.58	.43	
	.59	.51	.66	.39	.56	.48	
	.59	.47	.65	.33	.46	.49	
	.57	.43	.64	.33	.45	.53	
Science & Social Studies	.46	.31	.34	.30	.32		
	.47	.32	.43	.26	.36		
	.48	.33	.46	.24	.24		
	.47	.26	.45	.23	.26		
Spelling	.45	.42	.57	.34			
	.39	.36	.59	.25			
	.26	.27	.42	.15			
	.24	.13	.44	.26			
Word Study Skills	.45	.29	.40				
	.36	.28	.29				
	.38	.25	.30				
	.35	.22	.23				
Language	.58	.49					
	.58	.51					
	.60	.49					
	.59	.49					
Arithmetic Computation	.66						
	.67						
	.66						
	.64						

*In each cell of this table, the topmost correlation figure is that for the 11 year old and under group; the second is for the 12-13 year old group; the third is for the 14-16 year old group; and the bottom-most figure is for students 17 years old and up.

TABLE 10: INTERCORRELATION MATRIX FOR THE INTERMEDIATE I BATTERY, STANFORD ACHIEVEMENT TEST, FOR HEARING IMPAIRED STUDENTS, BY AGE GROUP.

Test	Social Studies	Science	Arithmetic Applications	Arithmetic Concepts	Arithmetic Computation	Language	Word Study Skills	Spelling	Paragraph Meaning
Word Meaning	.47*	.52	.42	.40	.21	.52	.40	.49	.64
	.46*	.53	.43	.41	.27	.53	.37	.48	.61
	.54*	.57	.48	.46	.33	.56	.41	.55	.64
	.47*	.52	.43	.42	.31	.54	.39	.54	.60
Paragraph Meaning	.63	.66	.59	.53	.30	.61	.50	.55	
	.62	.64	.55	.46	.35	.61	.42	.52	
	.60	.60	.53	.48	.32	.61	.40	.53	
	.59	.63	.56	.52	.39	.62	.39	.56	
Spelling	.54	.58	.48	.46	.44	.69	.43		
	.47	.47	.46	.43	.41	.63	.37		
	.49	.47	.40	.39	.40	.66	.36		
	.50	.49	.46	.41	.47	.64	.45		
Word Study Skills	.39	.46	.39	.39	.23	.55			
	.44	.41	.45	.39	.33	.49			
	.31	.36	.40	.36	.31	.42			
	.31	.32	.39	.37	.20	.44			
Language	.62	.63	.59	.57	.41				
	.61	.57	.61	.54	.47				
	.62	.57	.60	.57	.50				
	.58	.56	.56	.52	.47				
Arithmetic Computation	.49	.33	.55	.58					
	.43	.30	.62	.64					
	.49	.38	.62	.64					
	.54	.37	.64	.64					
Arithmetic Concepts	.64	.52	.74						
	.62	.48	.77						
	.66	.52	.75						
	.70	.53	.78						
Arithmetic Applications	.70	.59							
	.67	.59							
	.69	.60							
	.70	.58							
Science	.67								
	.67								
	.69								
	.67								

*In each cell of this table, the topmost correlation figure is that for the 13 year old and under group; the second is for the 14-15 year old group; the third is for the 16-17 year old group; and the bottom-most figure is for students 18 years old and up.

TABLE 11: INTERCORRELATION MATRIX FOR THE INTERMEDIATE II BATTERY, STANFORD ACHIEVEMENT TEST, FOR HEARING IMPAIRED STUDENTS, BY AGE GROUP.

Test	Social Studies	Science	Arithmetic Applications	Arithmetic Concepts	Arithmetic Computation	Language	Spelling	Paragraph Meaning
Word Meaning	.57*	.68	.46	.42	.26	.60	.57	.68
	.51*	.68	.45	.39	.22	.55	.54	.72
	.58*	.59	.47	.37	.34	.57	.61	.60
	.46*	.55	.39	.31	.28	.50	.59	.56
Paragraph Meaning	.61	.73	.52	.43	.33	.63	.56	
	.61	.69	.50	.39	.25	.55	.48	
	.66	.69	.58	.47	.37	.56	.51	
	.59	.63	.49	.38	.37	.56	.56	
Spelling	.58	.49	.53	.40	.44	.71		
	.45	.40	.40	.35	.36	.65		
	.53	.43	.46	.37	.47	.71		
	.48	.39	.46	.35	.43	.61		
Language	.66	.58	.56	.46	.43			
	.56	.49	.53	.50	.45			
	.59	.54	.56	.51	.57			
	.55	.54	.62	.58	.59			
Arithmetic Computation	.50	.31	.71	.61				
	.43	.24	.64	.63				
	.54	.35	.70	.69				
	.48	.28	.71	.75				
Arithmetic Concepts	.55	.43	.73					
	.56	.43	.75					
	.55	.45	.76					
	.54	.35	.78					
Arithmetic Applications	.68	.55						
	.69	.54						
	.69	.57						
	.62	.45						
Science	.70							
	.65							
	.69							
	.59							

*In each cell of this table, the topmost correlation figure is that for the 14 year old and under group; the second is for the 15-16 year old group; the third is for the 17-18 year old group; and the bottom-most figure is for students 19 years old and up.

TABLE 12: INTERCORRELATION MATRIX FOR THE ADVANCED BATTERY, STANFORD ACHIEVEMENT TEST, FOR HEARING IMPAIRED STUDENTS, BY AGE GROUP.

Test	Social Studies	Science	Arithmetic Applications	Arithmetic Concepts	Arithmetic Computation	Language	Spelling
Paragraph	.76*	.73	.58	.62	.47	.76	.66
Meaning	.79*	.73	.57	.55	.35	.71	.60
	.85*	.68	.59	.57	.40	.71	.52
	.82*	.72	.63	.58	.51	.77	.69
Spelling	.64	.49	.46	.53	.54	.78	
	.66	.54	.51	.57	.48	.77	
	.54	.36	.40	.54	.52	.70	
	.74	.61	.55	.66	.60	.76	
Language	.73	.62	.52	.63	.58		
	.76	.65	.62	.68	.59		
	.72	.57	.59	.62	.56		
	.81	.69	.71	.71	.69		
Arithmetic	.52	.42	.62	.72			
Computation	.49	.42	.61	.75			
	.39	.34	.60	.74			
	.56	.51	.67	.81			
Arithmetic	.69	.61	.77				
Concepts	.69	.65	.74				
	.62	.51	.75				
	.70	.62	.77				
Arithmetic	.71	.63					
Applications	.72	.63					
	.64	.55					
	.76	.66					
Science	.77						
	.78						
	.72						
	.80						

*In each cell of this table, the topmost correlation figure is that for the 15 year old and under group; the second is for the 16-17 year old group; the third is for the 18 year old group; and the bottom-most figure is for students aged 19 years old and up.

and Grade 3. For the Intermediate II battery the rise is from .66 to .70 between Grade 5 and Grade 6. The figures for the Advanced battery are somewhat less clear-cut, with mean correlations of .66, .69, and .68 for Grades 7, 8, and 9 respectively. The trends, in any case, seem generally to be in opposite directions for the hearing impaired and the standardization groups.

These results, both those for the age groups and those for the hearing impaired versus the standardization group, suggest the possibility of different factor structures for the hearing impaired group as compared with the standardization group and of different trends in change of factor structure across age for the two groups. These factor analyses have not yet been done, but might prove to be very instructive in the investigation of the organization of academic abilities in the hearing impaired student population as compared with the general hearing population.

AVERAGE INTERCORRELATION OF A SUB-TEST WITH ALL OTHER SUB-TESTS IN THE BATTERY

A final issue of concern with respect to the intercorrelations is the question of which sub-tests have the highest average intercorrelations with all the other sub-tests in the battery. This has practical implications

for testing of hearing impaired students as one basis for selection of a screening device.[3] A sub-test which has a high average intercorrelation with all other sub-tests in the battery will be a better predictor of overall performance than another sub-test which has a lower average intercorrelation, and therefore will be more appropriate as a screening test. Table 13 lists the average intercorrelations for all sub-tests of the five batteries employed in the 1971 testing program. For comparison purposes the average intercorrelations are reported both for the hearing impaired group and for the standardization group.

Examination of these tables shows that for the Primary I level, Paragraph Meaning has the highest average correlation; for Primary II, it is second by one point (i.e., .54 as compared with .55 for the Word Meaning Sub-test). For the three upper levels, Paragraph Meaning ranks fourth, after Social Studies, Language, and Arithmetic Applications, although the differences among the average intercorrelations for these four sub-tests are small at the upper levels.

In relating these findings to the problem of selecting a particular sub-test to serve as the screening instrument, two considerations are relevant. First, it seems desirable to maintain the greatest possible simplicity in the procedures for achievement testing, since a large number of factors already enter into the use

[3]For a review of the screening procedures and their rationale, see Office of Demographic Studies publications Series D, Number 9, *Academic Achievement Test Results of a National Testing Program for Hearing Impaired Students, United States: Spring 1971* and Series D, Number 11, *Studies in Achievement Testing, Hearing Impaired Students, United States: Spring 1971.*

TABLE 13: AVERAGE INTERCORRELATIONS OF THE SUB-TESTS WITH ALL OTHER SUB-TESTS IN THE SAME BATTERY, HEARING IMPAIRED STUDENTS AND STANDARDIZATION GROUP STUDENTS, SPRING 1971.

Sub-test	Primary I		Primary II		Intermediate I		Intermediate II		Advanced	
	SG*	HI**	SG	HI	SG	HI	SG	HI	SG	HI
Word Meaning	.67	.55	.70	.50	.69	.47	.72	.50	--	--
Paragraph Meaning	.64	.54	.72	.54	.73	.53	.75	.52	.73	.63
Vocabulary	.56	.28	--	--	--	--	--	--	--	--
Science & Social Studies Concepts	--	--	.56	.41	--	--	--	--	--	--
Spelling	.65	.49	.64	.41	.66	.49	.63	.50	.54	.58
Word Study Skills	.68	.41	.65	.28	.71	.35	--	--	--	--
Language	--	--	.68	.51	.73	.56	.74	.56	.72	.68
Arithmetic Computation	--	--	.55	.43	.58	.42	.62	.45	.68	.53
Arithmetic Concepts	.62	.48	.68	.52	.65	.53	.71	.51	.71	.65
Arithmetic Applications	--	--	--	--	.68	.56	.73	.58	.66	.62
Science	--	--	--	--	.71	.52	.73	.52	.73	.60
Social Studies	--	--	--	--	.72	.56	.70	.58	.64	.69

*SG = Standardization Group

**HI=Hearing Impaired Group

of such tests with hearing impaired students. On this basis, it would be more appropriate to use the Paragraph Meaning Sub-test as the screening test at all levels simply for the sake of uniformity and simplicity. The second consideration reinforces the first and involves the fact that for this 1971 testing program over 70 percent of all students tested were tested at the two primary levels. With these considerations in mind, the choice of the Paragraph Meaning Sub-test as the screening instrument for this testing program and for future testing purposes seems to be an appropriate one.

SUMMARY

This study has examined the intercorrelations among the sub-tests of the Stanford Achievement Test for hearing impaired students. By comparison with the hearing standardization group, the correlations for the hearing impaired group tend to be lower in most instances. When considered across age groups, the correlations for the hearing impaired students tend to decrease as age increases, except for the Advanced battery in which the correlations increase with age. This is different from the standardization group, in which the general tendency is for correlations to increase with age at all test levels. Finally, consideration of the average intercorrelations of each sub-test with all other sub-tests in the same battery suggests that the Paragraph Meaning Sub-test is the best single sub-test to use as a screening device for assigning the most appropriate battery with which to test a hearing impaired student.

Results of a Survey on the Use of Achievement Tests in Educational Programs For Hearing Impaired Students: United States, 1972-73

Carol Buchanan

INTRODUCTION

In 1968 the attention of the Annual Survey of Hearing Impaired Children and Youth was directed to the need for research in the area of the achievement tests being administered to hearing impaired students. Only the Form B Elementary Level Reading Sub-test of the 1958 Metropolitan Achievement Test had been standardized for hearing impaired students at that time; therefore, most programs were presumably using tests normed only on normally hearing students. Obvious questions about the reliability and validity of test scores arise when a test is administered to persons for whom it was not designed and upon whom it was not standardized. Part of the resources of the Annual Survey was therefore committed to determining the suitability of such tests for hearing impaired students and, to the extent necessary to obtain accurate measurement, to devising modified test materials and procedures.

Because of the complexity involved in evaluating the appropriateness of such a test, efforts were concentrated on one test. The Stanford Achievement Test was selected for study on the basis of data obtained at the time of the first Annual Survey indicating that the Stanford was the most commonly used test in educational programs for hearing impaired students. Accordingly, two National Achievement Testing Programs were conducted by the Annual Survey, in 1969 and again in 1971, to obtain information on the performance of hearing impaired students on the Stanford Achievement Test Series.[1]

THE PURPOSE OF THE 1972-73 ACHIEVEMENT TESTING SURVEY

The first two achievement testing programs made use of the 1964 edition of the Stanford test, then the current edition. During 1972 the publishers of the Stanford test were engaged in the preparation of a new test series, to be published as the 1973 edition of the Stanford Achievement Test. The changes from the previous (1964) edition were extensive, reflecting the changes in school curricula since the early 1960's.

[1]The data from these programs are reported in publications: *Academic Achievement Test Performance of Hearing Impaired Students, United States: Spring 1969*. Gallaudet College, Office of Demographic Studies, Series D, Number 1. *Item Analysis of Academic Achievement Tests Hearing Impaired Students, United States: Spring 1969*. Gallaudet College, Office of Demographic Studies, Series D, Number 2. *Item Analysis of an Achievement Testing Program for Hearing Impaired Students, United States: Spring 1971*. Gallaudet College, Office of Demographic Studies, Series D, Number 8. *Academic Achievement Test Results of a National Testing Program for Hearing Impaired Students, United States: Spring 1971*. Gallaudet College, Office of Demographic Studies, Series D, Number 9. *Studies in Achievement Testing, Hearing Impaired Students, United States: Spring 1971*. Gallaudet College, Office of Demographic Studies, Series D, Number 11.

After consultation with educators and other professionals working with hearing impaired students, it was determined that further achievement testing activities of the Annual Survey should use the new edition of the Stanford, *if* it were still the case that the Stanford series was the most widely used achievement test in programs for hearing impaired students. To make this determination, a survey of the usage of achievement tests in educational programs for hearing impaired students was begun in the fall of 1972.

PROCEDURES

The first step involved an attempt to identify all special educational programs for hearing impaired students in the United States. In conjunction with many sources, especially the Conference of Executives of American Schools for the Deaf, a list of more than 1100 possible programs was constructed. Approximately 230 programs were deleted from the list either because they served only preschool children or because a determination could not be made concerning the exact nature of the students they served. The remaining 864 programs to which the survey postcard was sent were divided into three groups on the basis of the degree of their involvement with Annual Survey data collection activities in the past. It was assumed that the degree of past involvement with the Annual Survey would be a factor associated with the type of achievement test used in the various programs. In line with this assumption the results which follow will be reported for each of three levels of involvement.

The first group of 280 programs consisted of those programs which had participated in the 1971 Achievement Testing Program and which also supplied demographic information to the Annual Survey for that year. A total of 292 programs participated in the 1971 program, but this number dropped to 280 due to the consolidation of some programs and the discontinuation of others.

The second group, consisting of 356 programs, included those who reported demographic information to the Annual Survey, but had not participated in the 1971 testing program.

The third group of 228 programs consisted of those which had not participated in the 1971 testing program and were not supplying demographic information to the Annual Survey, but were known to be still in operation, providing special educational services to hearing impaired students.

The survey postcard, a copy of which is reproduced below, was then sent to each of the programs in the three groups described, along with appropriate explanatory materials describing the purpose of the survey and the method of answering the survey questions. A follow-up mailing, again containing a copy of the survey postcard and explanatory materials, was sent to those programs which had not responded to the original mailing within approximately one month.

RESULTS OF THE SURVEY

A total of 735 programs out of the 864 contacted responded to the survey, for an overall response rate of 85.1 percent. The response rates for the three groups of programs described above appear in Table 1-A. The response rates for Groups 1 and 2 (programs participating in the Annual Survey) are both substantially higher than the rate for Group 3 (programs not

NATIONAL SURVEY OF ACHIEVEMENT TESTING WITH HEARING IMPAIRED STUDENTS

NAME_____

TITLE_____

1. Are you administering a standardized achievement test to your hearing impaired students during this 1972-73 school year?
   ☐ YES ☐ NO

If "YES" please answer Questions 2, 3, and 4.

If "NO" please answer Question 2.

2. Do you plan to administer a standardized achievement test to your hearing impaired students NEXT YEAR (1973-74 school year)
   ☐ YES ☐ NO

3. Which achievement test(s) are you administering this year? Check all that apply.
   ☐ Stanford Achievement Test, 1964
   ☐ Stanford Early School Ach. Test
   ☐ Metropolitan Ach. Test, 1970
   ☐ Metropolitan Ach. Test, 1958
   ☐ Iowa Test of Basic Skills
   ☐ American School Ach. Tests
   ☐ California Ach. Tests, 1970
   ☐ California Ach. Tests, 1957
   ☐ Wide Range Achievement Test
   ☐ Gates-MacGinitie Reading Tests
   ☐ Gray-Votaw-Rogers Test
   ☐ Other_____
   (name of test)

4. Approximate number of Hearing Impaired Students to be tested _____.

TABLE 1: NUMBER AND PERCENT OF MAIL SURVEY RESPONSES AND USABLE DATA, AND EXTENT OF ACHIEVEMENT TESTING AMONG RESPONDENTS FOR THE 1972-73 SCHOOL YEAR.

1-A: NUMBER AND PERCENT OF RESPONSES TO THE MAIL SURVEY.

Program Category	Programs Contacted		Responses Received	
	Number	Percent	Number	Percent
All Programs	864	100	735	85.1
Group 1	280	100	250	89.3
Group 2	356	100	320	89.9
Group 3	228	100	165	72.4

1-B: NUMBER AND PERCENT OF USABLE DATA AMONG RESPONSES TO THE MAIL SURVEY.

Program Category	Data Received		Data Inapplicable		Data Unusable		Data Usable	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Programs	735	100	69	9.4	30	4.1	636	86.5
Group 1	250	100	4	1.6	3	1.2	243	97.2
Group 2	320	100	43	13.4	20	6.3	257	80.3
Group 3	165	100	22	13.3	7	4.2	136	82.5

1-C: NUMBER AND PERCENT OF RESPONDING PROGRAMS TESTING DURING THE 1972-73 SCHOOL YEAR.

Program Category	Usable Responses Received		Programs Testing	
	Number	Percent	Number	Percent
All Programs	636	100	375	59.0
Group 1	243	100	199	81.9
Group 2	257	100	118	45.9
Group 3	136	100	58	42.6

participating in the Annual Survey). In 69 cases the information obtained on the survey postcard or in an accompanying letter indicated that the program was not appropriate for the survey, since the program provided no educational services, was intended solely for preschool, mentally retarded, or deaf-blind students, or was inappropriate for other reasons. In another 30 cases the responses to the survey were unclear or contradictory and were unable to be verified via telephone follow-up. Table 1-B shows the number and percent of responses in each of these categories for the three groups of programs and the number and percent of usable responses. Table 1-C indicates that, of the three groups of programs, Group 1 contained the highest proportion of programs intending to administer an achievement test to their students during the 1972-73 school year. This trend is to be expected since, by definition, Group 1 programs were sufficiently involved in achievement testing to have agreed to join the 1971 National Testing Program and thus to have administered at least the Stanford Achievement Test during the 1970-71 school year. Less than half the programs in Groups 2 and 3 indicated plans to use an achievement test during the current school year.

The responses to the survey questions regarding testing plans for the current year and for the subsequent year fell into six categories:

(1) testing both this year and next year;
(2) testing this year but not next year;
(3) testing this year but unsure of next year;
(4) not testing this year but testing next year;
(5) not testing this year and unsure of next year;
(6) not testing either year.

Table 2 shows the number and percent of programs in each of the three groups whose responses fell into the six categories described above. The responses indicate that a majority of programs in all three groups (87.6 percent, 59.9 percent, and 58.9 percent for Groups 1, 2, and 3 respectively) plan to use an achievement test during at least one of the two years surveyed.

On the postcard questionnaire, the respondents were directed to "check all that apply" in indicating the achievement tests they planned to administer during the 1972-73 school year. Since the Stanford Achievement Test was the most frequent choice, the data are displayed in Table 3 in relation to the selection of that test. The three resulting categories are:

(1) using only the Stanford test;
(2) using the Stanford test along with some other achievement test(s);
(3) using only some test other than the Stanford test.

Table 3 displays the survey results in these three categories, both for the numbers of programs choosing each possibility and for the number of students to be tested under each condition. Examination of Table 3 indicates that 75 percent of the programs in Group 1 chose the Stanford test either exclusively or in combination with other tests. However, most programs in Groups 2 and 3 (62 percent and 66 percent respectively) selected tests other than the Stanford. In terms of the numbers of students being tested, 84 percent of the students in Group 1 programs, 65 percent of those in Group 2 programs, and 50 percent of those

TABLE 2: NUMBER AND PERCENT OF RESPONDING PROGRAMS IN EACH OF THREE GROUPS OF PROGRAMS, ACCORDING TO THE PATTERN OF RESPONSE REGARDING TESTING PLANS FOR THE 1972-73 AND 1973-74 SCHOOL YEARS.

Category of Testing Plans	All Groups Combined		Group 1		Group 2		Group 3	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
TOTAL	636	100	243	100	257	100	136	100
Testing Both Years	347	54.6	186	76.5	107	41.6	54	39.7
Testing 72-73, Unsure 73-74	21	3.3	10	4.1	9	3.5	2	1.5
Testing 72-73, *Not* 73-74	7	1.1	3	1.2	2	0.8	2	1.5
Not testing 72-73, testing 73-74	72	11.3	14	5.8	36	14.0	22	16.2
Not testing 72-73, unsure 73-74	39	6.1	15	6.2	19	7.4	5	3.7
Not testing either year	150	23.6	15	6.2	84	32.7	51	37.5

TABLE 3: FREQUENCY OF TEST SELECTION RELATIVE TO THE STANFORD ACHIEVEMENT TEST.

	PROGRAMS				STUDENTS			
	TOTAL	Stanford Test Only	Stanford with Other Tests	Other Tests*	TOTAL	Stanford Test Only	Stanford with Other Tests	Other Tests*
All Groups	375	109	106	160	29,023	10,549	11,743	6,731
Group 1	199	81	69	49	21,990	8,752	9,682	3,356
Group 2	118	22	23	73	4,447	1,272	944	2,231
Group 3	58	6	14	38	2,586	525	1,117	944

*Includes those responses which indicated that a specific test had not been decided upon.

in Group 3 programs were in programs planning to use the Stanford test, either alone or in conjunction with other tests. Since in Groups 2 and 3 the majority of *programs* chose tests other than the Stanford, while the majority of *students* were receiving the Stanford test, it is apparent that programs with larger student enrollments are more likely to use the Stanford test than are smaller schools. Table 4 shows the average number of students being tested per program, by program group and test selection category.

TABLE 4: THE AVERAGE NUMBER OF STUDENTS TESTED PER PROGRAM IN 1972-73 BY GROUP AND TEST SELECTION CATEGORY.

	Total	Stanford Test Only	Stanford with Other Tests	Other Tests*
All Groups	77.4	96.8	110.8	42.1
Group 1	110.5	108.0	140.3	68.5
Group 2	37.7	57.8	41.0	30.6
Group 3	44.6	87.5	79.8	24.8

*Includes those responses which indicated that a specific test had not been decided upon.

Tables 5 and 6 present the detailed information upon which Table 3 was based. The number of programs selecting each test is reported in Table 5. Table 6 shows the number of students being tested with each specific achievement test. Columns headed by the name of a specific achievement test present data for situations in which that test *alone* was selected. Combinations of tests are reported in the third and fourth columns, headed "SAT with others" and "Others in Combination."

SUMMARY AND CONCLUSIONS

A mail survey regarding the usage of achievement tests was sent to 864 educational programs for hearing impaired students throughout the United States. A total of 735 responses was received, for a response rate of 85.1 percent. Ninety-nine replies were eliminated, either as coming from inappropriate programs or as being undecipherable. Of the remaining 636 usable replies, 375 (59 percent) indicated plans to use an achievement test during the 1972-73 school year, for a total of 29,023 students to be tested. Of the programs indicating testing plans for the current school year (1972-73), 215 programs (57 percent) reported plans to use the Stanford Achievement Test, either alone or in combination with some other achievement test. These 215 programs would be testing 22,292 students, or 77 percent of the total reported as being tested with any achievement test this year. The Stanford test is clearly the most frequently used test among these programs, whether considered as the only achievement test being used or as one of a combination of tests being used by the reporting programs. The survey results indicate that the Stanford alone will be administered to 10,549 students; the next most frequently used single test is the 1970 Metropolitan Achievement Test, being administered to 681 students.

The abbreviations for the various achievement tests listed in the postcard questionnaire which appear in Tables 5 and 6 on the succeeding pages are as follows:

SAT	Stanford Achievement Test, 1964
SESAT	Stanford Early School Achievement Test
'70 MAT	Metropolitan Achievement Test, 1970
'58 MAT	Metropolitan Achievement Test, 1958
Iowa	Iowa Test of Basic Skills
Americ.	American School Achievement Tests
'70 Cal.	California Achievement Tests, 1970
'57 Cal.	California Achievement Tests, 1957
WRAT	Wide Range Achievement Test
GMAC	Gates — MacGinitie Reading Tests
GVR	Gray — Votaw — Rogers Test

TABLE 5: NUMBER OF PROGRAMS ADMINISTERING EACH ACHIEVEMENT TEST IN 1972-73 BY PROGRAM AND RESPONSE CATEGORIES.

	All Tests	SAT only	SAT w/ others	Others in Combination	SESAT	'70 MAT	'58 MAT	Iowa	Americ.	'70 Cal.	'57 Cal.	WRAT	GMAC	GVR	Others	Unknown
All Respondents Testing This Year	375	109	106	57	1	20	9	12	3	8	4	24	3	1	15	3
Former Ach. Test. Participants: TOTAL Testing This Year	199	81	69	10	–	8	5	2	2	4	3	7	2	1	2	3
Testing This Year & Next	186	76	66	9	–	7	5	2	2	4	3	5	1	1	2	3
Testing This Year, Next Year Unknown	10	4	3	–	–	1	–	–	–	–	–	1	1	–	–	–
Testing This Year, Not Next Year	3	1	–	1	–	–	–	–	–	–	–	1	–	–	–	–
Participants in Basic Data Survey Only: TOTAL Testing This Year	118	22	23	31	1	8	3	4	–	1	1	14	1	–	9	–
Testing This Year & Next	107	20	20	29	1	7	3	3	–	1	1	13	1	–	8	–
Testing This Year, Next Year Unknown	3	2	3	2	–	1	–	–	–	–	–	–	–	–	1	–
Testing This Year, Not Next Year	2	–	–	–	–	–	–	1	–	–	–	1	–	–	–	–
Non-participants in Both: TOTAL Testing This Year	58	6	14	16	–	4	1	6	1	3	–	3	–	–	4	–
Testing This Year & Next	54	5	13	16	–	4	1	6	1	3	–	2	–	–	3	–
Testing This Year, Next Year Unknown	2	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–
Testing This Year, Not Next Year	2	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–

TABLE 6: NUMBER OF STUDENTS ADMINISTERED EACH ACHIEVEMENT TEST IN 1972-73 BY PROGRAM AND RESPONSE CATEGORIES.

	All Tests	SAT only	SAT w/ others	Others in Combination	SESAT	'70 MAT	'58 MAT	Iowa	Americ.	'70 Cal.	'57 Cal.	WRAT	GMAC	GVR	Others	Unknown
All Respondents Testing This Year	29,023	10,549	11,743	1,993	6	681	594	285	195	461	950	515	200	219	480	152
Former Ach. Test. Participants: TOTAL Testing This Year	21,990	8,752	9,682	429	–	462	371	33	190	435	800	145	180	219	140	152
Testing This Year & Next	20,944	8,058	9,599	404	–	370	371	33	190	435	800	103	70	219	140	152
Testing This Year, Next Year Unknown	971	680	83	–	–	92	–	–	–	–	–	6	110	–	–	–
Testing This Year, Not Next Year	75	14	–	25	–	–	–	–	–	–	–	36	–	–	–	–
Participants in Basic Data Survey Only: TOTAL Testing This Year	4,447	1,272	944	1,055	6	193	21	25	–	15	150	308	20	–	242	–
Testing This Year & Next	4,104	1,129	854	973	6	186	21	24	–	15	150	300	20	–	230	–
Testing This Year, Next Year Unknown	334	143	90	82	–	7	–	–	–	–	–	–	–	–	12	–
Testing This Year, Not Next Year	9	–	–	–	–	–	–	1	–	–	–	8	–	–	–	–
Non-participants in Both: TOTAL Testing This Year	586	525	1,117	509	–	26	6	227	5	11	–	62	–	–	98	–
Testing This Year & Next	2,510	516	1,087	509	–	26	6	227	5	11	–	55	–	–	68	–
Testing This Year, Next Year Unknown	60	–	30	–	–	–	–	–	–	–	–	–	–	–	30	–
Testing This Year, Not Next Year	16	9	–	–	–	–	–	–	–	–	–	7	–	–	–	–

APPENDICES

Appendix I: Characteristics of Students Participating in the Achievement Testing Program and the Annual Survey of Hearing Impaired Children and Youth

Appendix II: Background of the Achievement Testing Program

Appendix III: Standardized Testing Procedures Developed for the Spring 1971 Achievement Testing Program

Appendix IV: Schools and Classes that Participated in the Achievement Testing Program

APPENDIX I

CHARACTERISTICS OF STUDENTS PARTICIPATING IN THE ACHIEVEMENT TESTING PROGRAM AND THE ANNUAL SURVEY OF HEARING IMPAIRED CHILDREN & YOUTH

Included here is a summary of the demographic characteristics of the students for whom achievement test results have been reported. Also shown are the distributions for these variables on the 41,109 students who participated in the Annual Survey of Hearing Impaired Children and Youth during the 1970-71 school year.

Preceding each table is the definition of the variable presented in the table.

AGE

The age of the students is the age as of December 31, 1970.

Age of Students	Students in the Achievement Testing Program		All Students in the Annual Survey of Hearing Impaired Children & Youth	
	Number	Percent	Number	Percent
Total	16,908	100.0	41,109	100.0
Under 6 Years	31	.2	5,387	13.1
6 - 9 Years	2,463	14.6	12,119	29.5
10 - 13 Years	6,760	40.0	12,275	29.9
14 - 17 Years	5,587	33.0	8,661	21.1
18 Years & Over	2,067	12.2	2,667	6.5

BETTER EAR AVERAGE

The better ear averages were determined by averaging the puretone thresholds for the speech range (500, 1000, and 2000 Hz) in the better ear. Better ear averages are given in decibels according to the ISO standard. For the purposes of tabulations, audiological data reported in the ASA standard were converted to the ISO standard by adding ten decibels to the ASA average. If the standard was not reported but a better ear average could be computed, the results were treated as if reported in ISO standard. The category "Information Not Available" includes those students for whom no audiological information was reported and those for whom better ear averages could not be determined due to the omission of results for one or more of the frequencies used to compute the average.

Better Ear Average	Students in the Achievement Testing Program		All Students in the Annual Survey of Hearing Impaired Children and Youth	
	Number	Percent	Number	Percent
Total Students	16,908	100.0	41,109	100.0
Information Not Available	2,890	17.1	9,055	22.0
Total Known Information	14,018	100.0	32,054	100.0
Under 25 dB	106	.8	1,126	3.5
25 - 39 dB	234	1.7	1,697	5.3
40 - 54 dB	652	4.7	2,388	7.4
55 - 64 dB	969	6.9	2,498	7.5
65 - 74 dB	1,543	11.0	3,541	11.0
75 - 84 dB	2,019	14.4	4,301	13.4
85 dB & Above	8,495	60.6	16,503	51.5

AGE AT ONSET OF HEARING LOSS

This table shows the age of the student when he lost his hearing. The category "Information Not Reported" includes students for whom this information was omitted and those for whom the response of "Unknown" was reported.

Age at Onset of Hearing Loss	Students in the Achievement Testing Program		All Students in the Annual Survey of Hearing Impaired Children & Youth	
	Number	Percent	Number	Percent
Total Students	16,908	100.0	41,109	100.0
Information Not Reported	2,319	13.7	6,891	16.8
Total Known Information	14,589	100.0	34,218	100.0
Onset at Birth	11,269	77.2	26,703	78.8
Under 1 Year	921	6.3	1,968	5.8
1 Year	999	6.8	1,942	5.7
2 Years	621	4.3	1,256	3.7
3 Years	328	2.2	721	2.1
4 - 6 Years	355	2.4	1,084	3.2
7 Years and over	96	0.7	544	1.6

AGE HEARING LOSS DISCOVERED

Presented in this table is the reported age the student's hearing loss was discovered. The "Information Not Reported" category includes the cases where the information was not available or unknown.

Age Hearing Loss Discovered	Students in the Achievement Testing Program		All Students in the Annual Survey of Hearing Impaired Children and Youth	
	Number	Percent	Number	Percent
Total Students	16,908	100.0	41,109	100.0
Information Not Reported	7,793	46.1	16,621	40.4
Total Known Information	9,115	100.0	24,488	100.0
Discovered at Birth	173	1.9	347	1.4
Under 1 Year	1,794	19.7	4,448	18.2
1 Year	2,442	26.8	6,022	24.6
2 Years	1,991	21.8	5,095	20.8
3 Years	1,071	11.7	2,754	11.2
4 - 6 Years	1,322	14.5	4,206	17.2
7 Years and Over	322	3.5	1,616	6.6

PROBABLE CAUSE OF HEARING LOSS

This table presents the probable cause of the student's hearing loss. The causes are shown in regard to occurrence of loss at birth or after birth. The table shows the number of times a particular cause was reported. The category "Information Not Reported" includes those students for whom this information was not reported or cases where there was no known cause of the loss. If two or more causes were attributed to the hearing loss of a child both causes are included. Percent distributions for this table are not shown.

Probable Cause of Hearing Loss	Students in the Achievement Testing Program	All Students in the Annual Survey of Hearing Impaired Children and Youth
Total Students	16,908	41,109
Information Not Reported	8,510	19,916
Causes at Birth		
Maternal Rubella	1,408	6,077
Other Complications of Pregnancy	607	1,518
Trauma at Birth	405	916
Prematurity	944	2,207
Rh Incompatibility	708	1,402
Hereditary	1,626	3,073
Other Causes at Birth	420	844
Causes After Birth		
Meningitis	896	2,017
Mumps	107	351
Measles	491	1,114
Otitis Media	192	927
Trauma	181	420
Fever	258	628
Other Causes After Birth	966	2,000

AGE STARTED EDUCATION PRIOR TO AGE SIX

This table presents data regarding the age a student began his education prior to age six. The category "Some Education, But Age Started Unknown" includes those who had educational training prior to age six, but the actual ages of the children when they started this training are unknown.

Age Started Education Prior to Age Six	Students in the Achievement Testing Program		All Students in the Annual Survey of Hearing Impaired Children and Youth	
	Number	Percent	Number	Percent
Total Students	16,908	100.0	41,109	100.0
Information Not Reported	4,331	25.6	9,049	22.0
Total Known Information	12,577	100.0	32,060	100.0
1 Year	192	1.5	1,122	3.5
2 Years	620	4.9	2,912	9.1
3 Years	2,046	16.3	5,800	18.1
4 Years	2,280	18.1	5,367	16.7
5 Years	2,614	20.8	6,134	19.1
Some Education, but Age Started Unknown	731	5.8	2,185	6.8
No Education Prior to Age Six	4,094	32.6	8,540	26.6

HISTORY OF PARENTAL DEAFNESS BEFORE AGE SIX

Shown here are the number of students whose parents either had normal hearing before age six or suffered a hearing loss prior to this age. The number refers to the number of students and not the number of parents.

History of Parental Deafness Before Age Six	Students in the Achievement Testing Program		All Students in the Annual Survey of Hearing Impaired Children and Youth	
	Number	Percent	Number	Percent
Total Students	16,908	100.0	41,109	100.0
Information Not Reported	4,596	27.2	12,515	30.4
Total Known Information	12,312	100.0	28,594	100.0
Both Parents Normal Hearing	10,909	88.6	25,506	89.2
Both Parents With Loss	612	5.0	1,044	3.7
One Parent With Loss	474	3.8	1,161	4.1
One Parent Normal Hearing, Information for Other Parent Not Reported	317	2.6	883	3.1

ADDITIONAL HANDICAPPING CONDITIONS

Additional handicapping conditions refers to educationally significant handicaps the students had in addition to impaired hearing. The table shows the number of times a particular handicapping condition was reported. The category "Number with No Handicaps" refers to those students for whom it was stated that no additional handicaps were present. The "Information Not Available" group includes those students for whom this information was not reported. The category "Total Number of Conditions" is the summation of all the handicapping conditions reported and not the number of students having these conditions. If a student had two additional handicaps, both handicaps are included. Percent distributions for this variable are not shown.

Additional Handicaps	Students in the Achievement Testing Program	All Students in the Annual Survey of Hearing Impaired Children and Youth
Total Students	16,908	41,109
Number with no Handicaps	10,676	23,874
Information Not Available	2,201	6,255
Total Number of Conditions	4,726	13,662
Brain Damage	63	168
Cerebral Palsy	432	1,123
Cleft Lip or Palate	54	214
Emotional and Behavioral Problems	1,233	3,338
Epilepsy	78	226
Heart Disorders	158	750
Learning Disabilities	459	910
Mental Retardation	782	2,440
Orthopedic Disorders	88	250
Perceptual Motor Disorders	657	1,885
Severe Visual	477	1,699
Other	245	659

APPENDIX II

Background of The Achievement Testing Program

The Office of Demographic Studies first became involved in the area of achievement testing in the spring of 1969. One of the important areas in which data were needed, according to the project's National Advisory Committee, was that of the outcomes of the educational process as measured by achievement tests. Information subsequently obtained from educational programs for the hearing impaired indicated that the Stanford Achievement Test was the most widely used measure of academic achievement for hearing impaired students. Consequently, the Stanford Series was used in a national survey of achievement testing of hearing impaired students conducted during the spring of 1969. The results of the more than 12,000 tests administered during that first program confirmed the general knowledge of educators of the deaf that hearing impaired students score substantially below average levels of achievement attained by their hearing agemates.[1] Of greater importance was the fact that the results indicated that large numbers of the students tested were receiving test batteries too advanced for their achievement level, with the result that many scores were at or below the level where guessing or random response becomes a major determinant of the obtained scores. It was therefore necessary to revise the measuring instruments themselves before an adequate measurement of the achievement of hearing impaired students could be obtained.

A second National Testing Program was undertaken in the spring of 1971, incorporating three innovations designed to handle the technical measurement problems encountered two years earlier. These were (1) a screening test procedure to determine the appropriate level at which a student should be tested; (2) practice tests to familiarize students with the mechanics of test-taking, a set of skills which seemed to be deficient in many of the students tested in 1969; and (3) a modification of the sub-tests which in the original version of the test were intended to be dictated by the teacher. The dictated items were, instead, printed in the student's test booklet so that the benefits of both dictation and reading of the item were available to the hearing impaired student. It is upon the data from this second National Testing Program that the studies in the present report have been based.

DESCRIPTION OF THE STANFORD ACHIEVEMENT TEST

The Stanford tests are described by their authors as:

> . . . comprehensive achievement tests developed to measure the important knowledges, skills, and understandings commonly accepted as desirable outcomes of the major branches of the elementary curriculum. The tests are intended to provide dependable measures of these outcomes, comparable from subject to subject and grade to grade, for use in connection with improvement of instruction, pupil guidance, and evaluation of progress.[2]

[1] The results of this program have been presented in detail in publications D-1 and D-2 from the Office of Demographic Studies, listed on the inside back cover.

[2] Kelley, T. L., Madden, R., Gardner, E. F., and Rudman, H. C. *Stanford Achievement Test: Directions for Administering Primary I Battery*. New York: Harcourt, Brace & World, Inc., 19[illegible], p. 2.

The 1971 National Testing Program used Form W of the 1964 edition of the Stanford test for the overall testing. Form X of the 1964 edition was used for the screening test procedure and for the retesting in the reliability study described in this publication. Each of the five batteries of this 1964 edition (Primary I, Primary II, Intermediate I, Intermediate II, and Advanced) covers academic materials in various subject areas appropriate for students within a specific grade range. For example, the Primary I battery is intended for use from the middle of Grade 1 to the middle of Grade 2. The titles of the sub-tests included in each battery are listed in Table A.

The content of the Stanford tests was based on a survey of the materials typically included in regular school curricula at the various grade levels included in the test, and the standardization of the final form of the test was carried out in school systems across the country. Curricula for the hearing impaired were not surveyed, and educational programs for the hearing impaired were not included in the standardization procedures.

PARTICIPANTS IN THE 1971 NATIONAL TESTING PROGRAM

All educational programs for the hearing impaired known to the Annual Survey in fall of 1970, 776 programs enrolling approximately 48,000 students, were contacted by letter and invited to participate in the testing program. Test materials and scoring services were offererd free of charge to the participating programs. A total of 292 programs accepted the invitation and tested over 19,000 students. Participation was voluntary on the part of the educational programs, and no follow-up effort was employed to encourage non-respondents or non-participating programs to participate in the national testing. The reason most frequently cited for non-participation was that the given program enrolled only preschool students or other students too young to be tested. Other programs declined participation because they had insufficient staff to administer the tests, because they were complying with school district testing programs using tests other than the Stanford, because they were itinerant programs with small numbers of students scattered across

TABLE A: SUB-TESTS CONTAINED IN SUCCESSIVE BATTERY LEVELS OF THE STANFORD ACHIEVEMENT TEST SERIES, FORM W.

Primary I	Primary II	Intermediate I	Intermediate II	Advanced
Word Reading	Word Meaning	Word Meaning	Word Meaning	
Parag. Meaning	Parag. Meaning	Parag. Meaning	Parag. Meaning	Parag. Meaning
Vocabulary	Science & Social Studies Concepts			
Spelling	Spelling	Spelling	Spelling	Spelling
Word Study Skills	Word Study Skills	Word Study Skills		
	Language	Language	Language	Language
	Arithmetic Computation	Arithmetic Computation	Arithmetic Computation	Arithmetic Computation
Arithmetic	Arithmetic Concepts	Arithmetic Concepts	Arithmetic Concepts	Arithmetic Concepts
		Arithmetic Applications	Arithmetic Applications	Arithmetic Applications
		Social Studies	Social Studies	Social Studies
		Science	Science	Science

wide geographical areas, and because of reservations about administering the Stanford tests to hearing impaired students. The final numbers of students who were tested at battery level are reported in Table B.

TABLE B: NUMBER OF ACHIEVEMENT TESTS ADMINISTERED ACCORDING TO TEST BATTERY LEVEL: SPRING 1971.

Test Battery Level	Number	Percent
All Levels	19,037	100.0
Primary I	6,786	35.6
Primary II	6,655	35.0
Intermediate I	3,215	16.9
Intermediate II	1,566	8.2
Advanced	815	4.3

QUALIFICATIONS AND LIMITATIONS OF THE TESTING RESULTS

Many of the qualifications and limitations of the testing results have been stated in previous publications from the Office of Demographic Studies dealing with the 1971 testing program,[3] and the reader is urged to review these statements before making use of the information contained in this report. Foremost among these is, of course, the fact that the Stanford test, reflecting, as it does, the curriculum of regular schools, has been developed and standardized for hearing students; consequently, any differences between the curriculum of regular schools and special educational programs for hearing impaired students will tend not only to reduce the scores for hearing impaired students but also the validity and reliability of the test results.

Also of major concern is the non-random method of selection of students for inclusion in the testing program. Appendix I of this publication reviews the demographic characteristics of the students tested in the 1971 program in relation to the characteristics of all students for whom information is available to the Annual Survey. Examination of these data suggests that the differences are not great except in the case of the age distribution. This is an expected and acceptable deviation, since preschool students and students under age 8 (who constitute a substantial proportion of the total Annual Survey group) are not ordinarily tested with achievement tests of the Stanford type.

Another characteristic of the age distribution is noteworthy, namely, the age distributions of students taking particular battery levels. The age range of hearing impaired students receiving a given battery is substantially broader than that encountered among hearing students. For example, 155 students aged 18 or above received primary level test batteries on the basis of screening test scores indicating that their achievement levels are within the primary range. Regardless of the accuracy of such assignments of testing levels, the presumed disparity between the content matter of primary level tests and the typical interest patterns of 18-year old students introduces a source of extraneous variance unrelated to actual academic ability but related instead to the motivational characteristics of older students being asked to respond to such materials. This is a measurement problem which will need to be handled in some other manner in future testing programs. The age distributions of hearing impaired students receiving each of the five batteries are presented in Table C.

The reports contained in this and previous publications regarding the 1971 Achievement Testing Program have presented data relating to the item analysis figures, means, and standard deviations of grade equivalents obtained by hearing impaired students according to degree of hearing loss, patterns of differential performance between the hearing impaired and standardization groups, reliability, and discriminative validity of the tests used in the 1971 program. Future reports will concentrate on the influence of other demographic characterstics on the achievement levels of hearing impaired students, on the influence of guessing or random response on the test scores, and on the intercorrelations among the sub-tests of each achievement battery. The achievement testing activities of the Office of Demographic Studies continue to be directed to the goal of improving the accuracy and usefulness of the tests used in the field of education of hearing impaired children and youth and to the assessment of the outcomes of the educational process by means of such improved tests.

[3]See Office of Demographic Studies publication D-8, pp. 2-3, and publication D-9, pp. 6-7.

TABLE C: NUMBER OF STANFORD ACHIEVEMENT TESTS INCLUDED IN THIS REPORT BY AGE AND TEST BATTERY LEVEL: SPRING 1971.

Age	Battery Level					
	All Levels	Primary I	Primary II	Intermediate I	Intermediate II	Advanced
All Ages Tested	19,037	6,786	6,655	3,215	1,566	815
Unknown Age	2,129	800	722	394	125	88
Total Students Included in This Report	16,908	5,986	5,933	2,821	1,441	727
Under 6	31	27	2	1*	1*	–
6	341	335	3	2	1*	–
7	454	425	25	2	1*	1*
8	697	606	85	6	–	–
9	971	718	238	11	3	1*
10	1,297	779	466	42	9	1*
11	1,600	765	737	72	25	1*
12	2,316	913	1,092	232	66	13
13	1,547	401	758	288	84	16
14	1,573	352	674	392	117	38
15	1,455	230	538	409	215	63
16	1,315	161	451	355	210	138
17	1,244	119	361	375	239	150
18	1,154	108	300	325	248	173
19	639	35	142	208	152	102
20	222	10	47	86	54	25
21 & Over	52	2	14	15	16	5

*These results are highly improbable and may reflect an error in scoring or the age given for the student who took the test.

APPENDIX III

Standardized Testing Procedures Developed for the Spring 1971 Achievement Testing Program

The analyses of data collected from the 1969 Achievement Testing Program indicated that different methods of administering the tests were being used among individual school and class programs. As test scores can be affected by the manner in which the test is given, it became necessary to establish uniform testing procedures. This served the purpose of making test administration procedures consistent throughout the schools and classes participating in the Spring 1971 testing program. It also ensured that test scores would be comparable from teacher to teacher and school to school. A description of the standardized procedures implemented to collect the data in this report is given below.

SCREENING TESTING OR PRE-TESTING OF STUDENTS

Analyses of the 1969 testing data demonstrated that many sub-tests, particularly at the Intermediate and Advanced battery levels, were not showing true differences between good and poor students. This occurred mainly because students were receiving test battery levels too high or too difficult for them. The number of items they were able to answer correctly was insufficient to show actual achievement differences, and scores tended to cluster about a chance or guessing range.

This guessing factor may result in a student's score being spuriously affected by the test battery level he receives. Generally, by guessing alone, the higher the battery level administered, the higher will be the scores. For example, if a beginning first grade student were administered the Social Studies Sub-test of the Advanced battery and merely guessed at each question, he would likely receive a 4.6 Grade Equivalent score. The criteria used to select test battery levels for students varied throughout the country. It was therefore necessary to establish valid battery selection methods that would be consistent among the participating schools. A screening testing procedure was implemented to accomplish this goal.

The selection of the screening test was, for the most part, based on the internal analyses of the 12,000 achievement records collected two years earlier. The search was to find one sub-test within the Stanford Series which best indicated how well a student would perform on the remainder of the sub-tests in the full battery. On the basis of various statistical analyses, the Paragraph Meaning Sub-test consistently proved to be the best predictor of overall student performance. In setting the specifications for using a Paragraph Meaning score to select the full battery, statistical adjustments were made which allowed for the fact that younger students generally scored higher in reading than on other test content areas, while older students scored relatively lower on reading than in the remainder of the test, e.g., Arithmetic Computation.

Two levels of screening tests were used, one appropriate for students achieving at a general level of the end of the fourth grade and below, and one for students estimated to be functioning at the beginning fifth grade level and above. In ordering screening test materials, the participating programs were asked to estimate the number of students maintaining a general academic level within each of these broad categories. The Paragraph Meaning Sub-test from the Primary II and Intermediate II batteries of the Stanford Series, Form X, were employed as the screening instruments. The school administered and scored the screening test. The number of items the student answered correctly was used to select the most valid battery level for him. Guidelines for using screening test scores were formulated and set by the Annual Survey.

PRACTICE TESTING TO INSTRUCT STUDENTS IN TEST-TAKING PROCEDURES

The directions to administer parts of the Stanford tests and the question-answer format of some test items proved difficult to follow for many students in special programs for the hearing impaired. They lacked exposure to this type of testing procedure. In analyzing the 1969 achievement test results, it became clear that many students took the test not understanding the test structure or how to mark their answers. The seriousness of this problem led the Annual Survey to develop sets of practice tests appropriate to each battery level of the Stanford Series. Samples of the test directions, questions, and answer marking procedures were included in the practice materials, along with an explanation of the purposes of academic achievement testing. Teacher manuals were developed to accompany the practice tests.

Participating programs received a practice test for each student and were requested to administer them two to four days prior to the Stanford full batteries. The practice tests were to be used directly to teach test-taking mechanics to the students and prepare them for their best performance on the real test. As the teachers gave the practice session, they became better prepared for administering the Stanford tests.

SPECIAL EDITION OF THE PRIMARY LEVEL TEST BATTERIES

The Primary I and II test levels, those intended for the academic range of the middle of Grade 1 to the end of Grade 3, contain many sub-tests structured to be administered by oral presentation. A hearing impaired student's response to a dictated question may be a function of his receptive communication skill and not his knowledge of the answer. Previously, schools attempted various procedures to overcome this problem — overheads, blackboards, and the like. To standardize presentation of the dictated sub-tests and make their design more valid, the Annual Survey arranged with the test authors and publisher for a special edition. This applied to the Primary I and II levels only and was called Form W-HI. The Intermediate and Advanced test levels are self-administering and contain no dictated test questions.

Within the Form W-HI edition, those test questions previously to be strictly dictated were also printed in the test booklet itself. The teacher was to dictate the question and then direct the student to read it in his own booklet before marking his answer. The procedure served to make uniform the administration of dictated sub-tests. In the Primary I, Form W-HI, modifications were made in the Vocabulary and Arithmetic Sub-tests. The Science and Social Studies Concepts and Arithmetic Concepts Sub-tests were modified at the Primary II level, Form W-HI.

APPENDIX IV

SCHOOLS AND CLASSES THAT PARTICIPATED IN THE ACHIEVEMENT TESTING PROGRAM

ALABAMA
- Alabama Institute for the Deaf and Blind
- Blossomwood Elementary School
- Children's Center of Montgomery, Inc.
- Holt Elementary School
- University of Montevalio Speech and Hearing Clinic

ALASKA
- Anchorage Borough School District

ARIZONA
- Arizona State School for the Deaf and Blind
- Phoenix Day School for the Deaf

ARKANSAS
- Jenkins Memorial Children's Center

CALIFORNIA
- Alhambra City School District
- Anaheim Union High School District
- Bellflower Unified School District
- Mary E. Bennett School for the Deaf
- Butte County Schools
- California School for the Deaf, Riverside
- Cedarcreek School for the Deaf
- Centralia School District
- Chula Vista City School District
- Covina Valley Unified School District
- El Centro Elementary School District
- Escondido Union School District
- Garden Grove Unified School District
- Goleta Union Elementary School District
- Kern County Schools
- La Mesa-Spring Valley School District
- Lancaster Elementary School District
- Livermore Valley Joint Unified School District
- Lompoc Unified School District
- Marin County Schools
- Marlton Elementary School
- Monterey County Schools
- Mt. Diablo Unified School District
- Oakland City Unified School District
- Orange Unified School District
- Pasadena City Unified School District
- Placer County Public Schools
- Riverside Unified School District
- San Bernardino County Schools
- San Diego Unified School District
- San Francisco County Schools
- San Jose City Unified School District
- San Juan Unified School District
- Santa Ana Unified School District
- Santa Clara Unified School District
- Santa Rosa City School District
- Simi Valley Unified School District
- Solano County Schools
- Stockton Unified School District
- Sutter County Schools
- Tehama County Public Schools
- Tulare County Schools
- Tulare Union High School District

COLORADO
- Colorado School for the Deaf and Blind
- John Evans School
- Meadow Elementary School

CONNECTICUT
- American School for the Deaf
- Class for Preschool Hearing Impaired Children, Hartford
- East Hartford Public Schools
- Green Acres School
- Hamden-New Haven Cooperative Educational Center
- Magrath School
- Mystic Oral School for the Deaf
- West Haven Department of Special Education

DELAWARE
- Margaret S. Sterck School for Hearing Impaired

DISTRICT OF COLUMBIA
- Capital Region Model Secondary School (MSSD)
- Kendall School for the Deaf
- Speech and Hearing Center-Public Schools of the District of Columbia

FLORIDA
- Brevard County Public Schools
- Florida School for the Deaf and Blind
- Leon County Program for Hearing Impaired Children
- Robert McCord Oral School
- Palm Beach County Schools
- Rock Lake Elementary School

GEORGIA
- Atlanta Public Schools
- Atlanta Speech School, Inc.
- Cobb County Board of Education
- Lawton B. Evans School
- Houston Speech and Hearing School
- Robert Shaw Center

HAWAII
- Central Intermediate School
- Diamond Head School for the Deaf
- McKinley High School

IDAHO
- Idaho School for the Deaf and Blind

ILLINOIS
- Bell Elementary School
- Bi-County Oral Deaf Program
- Black Hawk Hearing Handicapped Program
- Champaign Community Schools
- Chicago Vocational High School
- Decatur Public School District
- Elim Christian School for the Exceptional Child
- Ericson School
- Illinois School for the Deaf
- Jamieson School
- Marquette Elementary School
- Thomas Metcalf School
- Morrill Elementary School
- Northern Suburban Special Education District
- Northwest Suburban Special Education Organization
- Northwestern Illinois Association
- Perry School
- Ray School
- Reinberg School
- Scammon School
- Shields Elementary School
- South Metropolitan Association for Low-Incidence Handicapped
- Special Education District of Lake County
- Springfield Public Schools
- West Suburban Association for the Hearing Handicapped
- James Ward Elementary School

INDIANA
- Glenwood Elementary School
- Hammond Public Schools
- Indiana School for the Deaf
- Marion Community Schools
- Morrison-Mock School
- Fayette County Schools Corporation

IOWA
- Black Hawk-Buchanan County Board of Education
- Cedar Rapids Community Schools
- Hope Haven School
- Iowa School for the Deaf
- Wilson School-Oral Deaf Department

KANSAS
- Kansas School for the Deaf
- Wichita Public Schools

KENTUCKY
- Kentucky School for the Deaf
- Louisville Public Schools

LOUISIANA
- Acadia Parish School Board
- Lafayette Parish School Board
- Louisiana School for the Deaf
- Monroe City Schools
- Sunset Acres School

MAINE
- Governor Baxter State School for the Deaf

MARYLAND
- Baltimore County Department of Special Education
- Maryland School for the Deaf
- Montgomery County Public Schools
- Prince George's County Public Schools

MASSACHUSETTS
- Belmont Public Schools
- Beverly School for the Deaf
- Boston School for the Deaf
- Peter Bulkeley School
- Clarke School for the Deaf
- Lawrence Primary Program for the Deaf
- Leominster Day Classes for the Hearing Impaired
- Horace Mann School for the Deaf
- Mercer School
- Willie Ross School for the Deaf
- Upsala Street School
- Woburn Day Class Program
- Worcester County Hearing and Speech Center

MICHIGAN
- Howard D. Crull Intermediate School (Roosevelt Elementary)
- Detroit Day School for Deaf
- Douglas School
- Durant-Tuuri-Mott School
- Escanaba Area Jr. High School
- Ferndale Public Schools
- Handley School
- Ida Public Schools
- Kalamazoo Public Schools
- Ann J. Kellogg School
- Lakeview Elementary School
- Lakeview Public Schools
- Lindemann Elementary School
- Lutheran School for the Deaf
- Marquette Elementary
- Michigan School for the Deaf
- Oakland Schools
- Public School Program for Deaf and Hard-of-Hearing, Jackson
- Traverse City Public Schools
- Utica Schools

MINNESOTA
- Duluth Public Schools
- Minnesota School for the Deaf
- St. Paul Area Program for Impaired Hearing

MISSISSIPPI
- Mississippi School for the Deaf
- Popp's Ferry Elementary School

MISSOURI
- Central Institute for the Deaf
- Delaware Elementary School
- Litzsinger School
- Missouri School for the Deaf
- St. Louis County Special School District for the Handicapped
- School District of Kansas City

MONTANA
- Montana State School for the Deaf and Blind

NEBRASKA
- Nebraska School for the Deaf
- Omaha Public Schools
- Prescott Acoustically Handicapped Unit

NEVADA
- Ruby S. Thomas Elementary School

NEW HAMPSHIRE
- Crotched Mountain School for the Deaf

NEW JERSEY
- Bruce Street School
- Class for the Hard of Hearing, Kearny
- Cumberland County Public Schools
- Hackensack Program for the Deaf
- Marie H. Katzenbach School for the Deaf
- Millburn Avenue School
- Township Public Schools, Neptune
- Woodbridge Public School System

NEW MEXICO
- New Mexico School for the Deaf

NEW YORK
- Board of Cooperative Educational Services, Nassau
- Board of Cooperative Educational Services of Washington, Warren and Hamilton Counties
- Board of Cooperative Educational Services, Suffolk County II
- Board of Cooperative Educational Services, Suffolk County III
- Catholic Charities Day Classes for Deaf Children
- Mill Neck Manor Lutheran School
- New York School for the Deaf – White Plains
- New York State School for the Deaf – Rome
- Rochester School for the Deaf
- St. Francis De Sales School for the Deaf
- St. Joseph's School for the Deaf
- St. Mary's School for the Deaf
- School for Language and Hearing Impaired Children – Public School 158
- Union-Endicott Central School District

NORTH CAROLINA
- Eastern North Carolina School for the Deaf
- North Carolina School for the Deaf

NORTH DAKOTA
- Longfellow School
- North Dakota School for the Deaf

OHIO
- Alexander Graham Bell School for the Deaf, Cleveland
- Canton Public Schools
- Kennedy School for the Deaf
- Kent Public Schools
- Lakewood Public Schools
- Lorain Board of Education
- Mansfield City Schools
- Ohio School for the Deaf
- Program for Physically Handicapped, Toledo
- Springfield City Schools
- Youngstown Public Schools
- Zanesville Classes for Deaf

OKLAHOMA
- Kerr Junior High School
- Oklahoma City Public Schools
- Oklahoma School for the Deaf
- University of Oklahoma Medical Center

OREGON
- Oregon State School for the Deaf
- Portland Public Schools
- Tucker-Maxon Oral School
- Washington County Intermediate Education District

PENNSYLVANIA
- DePaul Institute
- Ebensburg State School and Hospital
- Erie City School District
- Home of the Merciful Saviour for Crippled Children
- Willis and Elizabeth Martin School
- Pennsylvania School for the Deaf
- Pennsylvania State Oral School for the Deaf
- Programs for Speech and Hearing Handicapped:
  - Centre County Schools
  - Clinton County Schools
  - Fayette County Schools
  - Northampton County Schools
- Western Pennsylvania School for the Deaf

RHODE ISLAND
- Rhode Island School for the Deaf

SOUTH CAROLINA
- Florence County School District #3
- Pate Elementary School
- South Carolina School for the Deaf and Blind

SOUTH DAKOTA
- South Dakota School for the Deaf

TENNESSEE
- Knox County Public Schools
- Memphis Parents' School for Deaf and Aphasic
- Tennessee School for the Deaf

TEXAS
- Abilene Public Schools – Day Class for the Deaf
- Austin Independent School District
- Bexar County School for the Deaf
- P.F. Brown Elementary School
- The Callier Hearing and Speech Center
- Corpus Christi Independent School District
- County-Wide Area Day School, El Paso
- Dallas Independent School District
- Hereford Independent School District
- Houston Independent School District
- Houston School for Deaf Children
- Tarrant County Day School for Deaf
- Texas School for the Deaf
- Wichita Falls Independent School District

UTAH
- Utah Schools for the Deaf and Blind
- Utah State University – Edith Bowen Laboratory School

VERMONT
- Austine School for the Deaf

VIRGINIA
- Arlington County Public Schools
- Charlottesville Public Schools
- Diagnostic, Adjustive and Corrective Center for Learning
- Virginia School for the Deaf and Blind
- Virginia State School for the Deaf at Hampton

WASHINGTON
- Bellevue Public Schools
- Bellingham School District #501
- Edna E. Davis School

Northshore School District #417
Seattle Public Schools
Shoreline School District #412
Washington State School for the Deaf

WEST VIRGINIA
West Virginia School for the Deaf and the Blind

WISCONSIN
City District Public Schools, La Crosse
Day School for the Deaf, Wausau
Lincoln Elementary, Eau Claire
Madison Public Schools
Pleasant Hill School
St. John's School for the Deaf
School for the Deaf, Green Bay
School for the Deaf, Oshkosh
E. H. Wadewitz School
Wisconsin School for the Deaf

WYOMING
Wyoming School for the Deaf

REPORTS FROM THE ANNUAL SURVEY OF HEARING IMPAIRED CHILDREN AND YOUTH

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SPECIAL REPORTS FROM THE OFFICE OF DEMOGRAPHIC STUDIES, GALLAUDET COLLEGE

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No. 1 National Survey of State Identification Audiometry Programs and Special Educational Services for Hearing Impaired Children and Youth — United States: 1972